

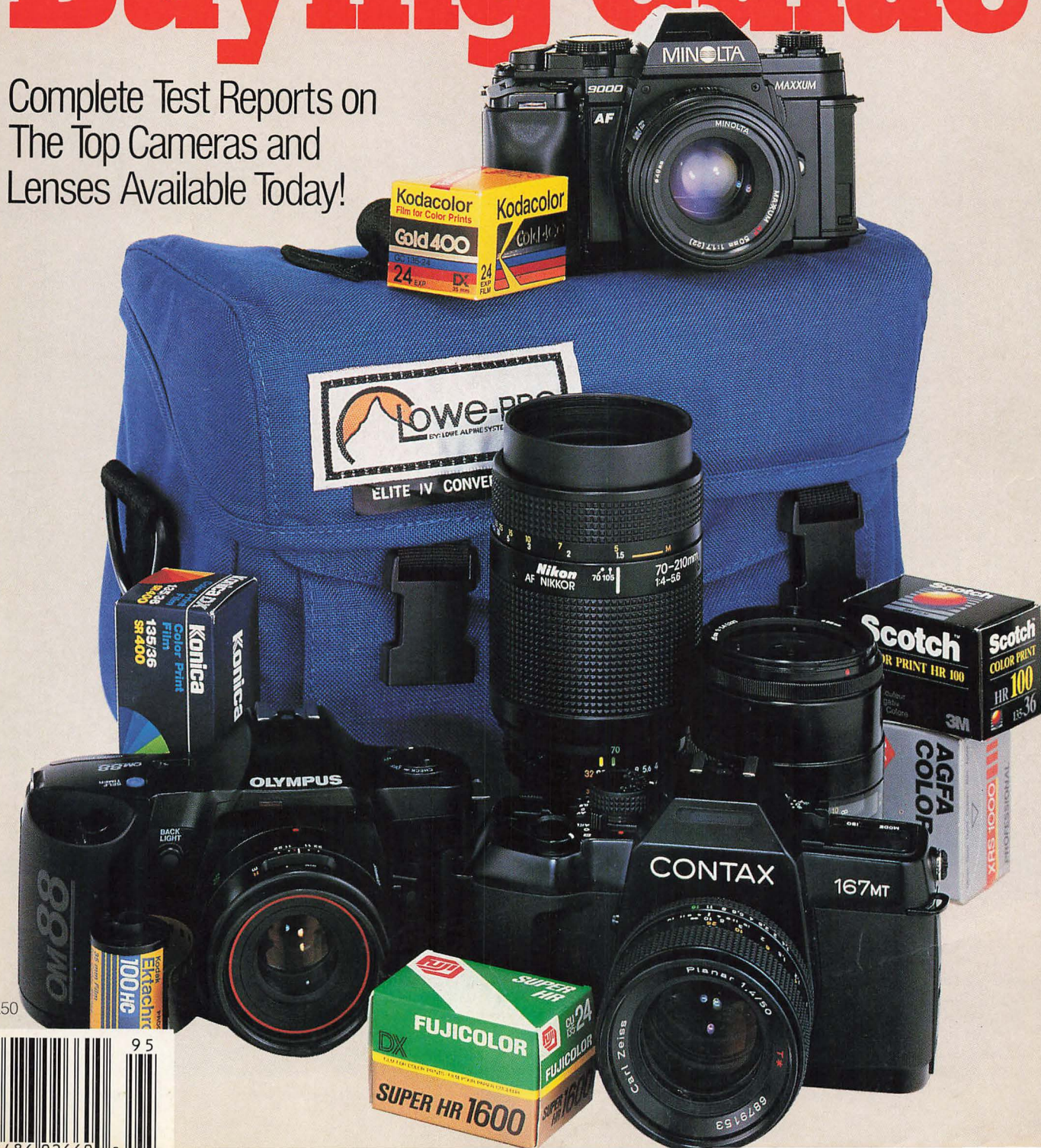
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Modern Photography's

# Photo '89 Buying Guide

**W**ith this 1989 edition, MODERN PHOTOGRAPHY'S Photo Buying Guide celebrates its 20th anniversary! Compiled from the authoritative test reports published each month in *Modern*, the Guide has been recognized as a definitive source of information on major cameras and lenses available at the time of each issue's publication.

*Modern Photography* first tested photographic equipment almost 40 years ago. Today, our test lab is one of the most comprehensive facilities of its kind—public or private—anywhere in the world. Every piece of equipment that measures up to our standards is rigorously put through its field-check paces and evaluated by our staff. Our Modern Tests feature provides readers with the most accurate, detailed and useful information available on new equipment. Our dedication to quality hasn't changed, and we're eager to continue this tradition on into the next 40 years.

This is the first year that the PHOTO BUYING GUIDE includes fully automatic cameras. Electronic wonders are closing the gap between SLRs and point-and-shooters. Are these new cameras right for you? Read on and find out!

We hope the PHOTO BUYING GUIDE 1989 will prove helpful when you're considering which cameras and lenses to add to your photo kit. Be sure to examine any piece of equipment that interests you *before* making a purchase. And, above all, consider your own needs and preferences while buying. The right equipment can be your key to great pictures.

Catherine Calhoun  
Editor



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# 35mm SINGLE LENS REFLEX

## CANON EOS 650: DAWN OF A NEW AUTOFOCUS SLR GENERATION

**MANUFACTURER'S SPECIFICATIONS:** Canon EOS autofocus 35mm single lens reflex camera. Body No.1009323. **LENS:** 50mm f/1.8 EF Canon In Canon EF bayonet mount. **SHUTTER:** Electronically controlled vertical travel Canon metal-coated Mylar blade focal plane with speeds from 30 to 1/2000 sec. plus B. **EXPOSURE SYSTEMS:** Segmented silicon photo cell above eyepiece reads evaluative or central limited area metering pattern with lock, for shutter priority, aperture priority, program (based on lens focal length), calculated depth-of-field autoexposure programs plus metered manual exposure. Second SPD in bottom of mirror box provides centerweighted, off-the-film readings for TTL autofocus. EV range 1-20 at ISO 100. Autofocus: Focus-priority AF or continuous (servo) AF using TTL phase detection with Canon BASIS sensor in bottom of mirror box, audible focus OK signal, EV 1-18. Lowlight autofocus aid flash provided by Canon 420/300 EZ flash units when fitted. **FLASH:** Five-pin dedicated hot shoe provides TTL flash off film surface with aperture and shutter speed predetermined by near infrared pre-exposure flash when using 420/300EZ Canon flash units, 1/60-1/125 X-sync speeds. Flash units have focus aid lights and auto power zooming heads. **VIEWFINDER:** Fixed eye-level prism with user-changeable finder screens. Standard screen has central autofocus rectangle, indicating circle for limited area metering and full area manual focus. LED-lit LCD display shows shutter speed, aperture, metered manual exposure level, depth-of-field program indications, AE lock, manual exposure indicator, flash ready, exposure compensation, autofocus indication, out of exposure and flash range warning signals. **OTHER FEATURES:** LCD on top plate displays shooting mode, film wind condition, AF mode, shutter speed, aperture, film speed, battery check. Auto DX film speed setting ISO 25-5000, manual ISO 6-6400, autolock, autowind, autotowind, single and sequence film advance, electronic self-timer with LED, depth-of-field preview, mid-roll rewind-provision, audible camera shake warning, provision for accessory data and command backs, interchangeable grips with or without remote control terminal. **BATTERIES:** All power supplied by single 6-volt lithium battery. **PRICE:** \$505.00.

Eleven years ago, Canon unveiled a series of electronically controlled cameras that

was destined to redefine the 35mm SLR and to position Canon at the cutting edge of photographic technology. Canon's A-series SLRs, including the phenomenally successful AE1 and the remarkably advanced A-1, paved the pathway all manufacturers would shortly follow in developing the single lens reflex camera. During the early 80s, Canon did anything but rest on its corporate laurels. The company aggressively evolved the fully computerized, ever-more automated, ergonomically styled "SLRs of the 90s," best exemplified by the T-70 with its computer-like controls and LCD readouts and the recent T-90, a masterpiece of integrated electronics with a dazzling array of exposure control systems and TTL autofocus capabilities.

Perhaps the only area where Canon elected not to concentrate the full force of its prodigious energies was the autofocus (AF) SLR. Given the technological and marketing realities of the late 70s and early 80s, this was understandable. The world's first true autofocus SLR, the Pentax ME-F, was an indifferent performer that bombed in the marketplace. Canon's own focus-assist model, the AL-1, worked better, but having a focus OK LED was not perceived as a great advance over traditional manual focusing. The one available autofocus optic for Canon SLRs, the square-bodied 35-70mm f/2.8 Canon with AF sensors and bulky motor in the lens, was an expensive and ungainly option.

When Minolta unleashed the Maxxum 7000 in 1985, Canon, along with every other Japanese camera maker, was jolted into the realization that the Autofocus SLR Age was indeed upon us. Minolta had had the foresight to conclude that it was poor execution, not the basic concept, that had prevented existing autofocus SLRs from being successful. Clearly they had done their homework in developing the first integrated autofocus SLR system worthy of the name.

Canon's initial response to the Maxxum was the T-80, an autofocus SLR that was basically an AF version of the entry-level automatic Canon T-50. It provided through-the-lens autofocus with a limited number of Canon AF lenses with motors built in, and focus confirmation with traditional Canon FD lenses. Unfortunately neither its AF performance nor its features were on a par with Maxxum's. It was a stopgap camera, as Canon knew only too well.

Canon was now determined to reaffirm its position of technological leadership by developing a first-class AF SLR system, but they knew it would take time. Pride spurred them to the oft-stated goal of producing "a better system than you-know whose," but even with Canon's phenomenal human and technical resources it took them two years to deliver it "on schedule." Is the new Canon EOS system truly better? Does it provide

real-world advantages over the half dozen or so other AF SLR systems now on the market? Let's examine the EOS 650, the "broad spectrum" model first brought to market, to see how well it has attained these lofty goals.

Where did Canon ever come up with a name like EOS, you ask? There are two alternative explanations, depending on whether you're an electronics buff or a classical romantic. If you're the former, EOS simply stands for "Electro-Optical System." More poetic souls may prefer to think of EOS as the ancient Greek goddess of the dawn.

In appearance, the EOS 650 bears an unmistakable resemblance to the Canon T-90, though its contours are less radically futuristic and curvilinear. It's a largish, handsome-looking camera finished in an attractive combination of smooth and sanded-texture black polycarbonate, with a nearly black, rubberized material on the removable right-hand finger grip and the non-removable thumbrest area on the right side of the back. Pick the 650 up and bring it to eye level and you'll immediately discover one of its sterling virtues even before you turn it on—it's extremely comfortable to hold and has a superbly balanced feel. The large, very soft rubber eye-cup is equally comfy and it excludes light effectively.

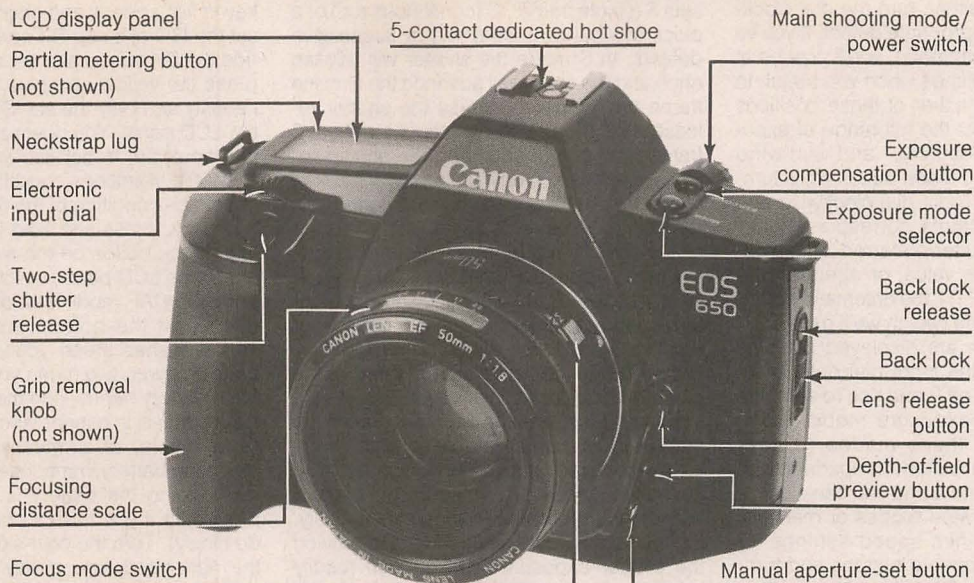
Press in the forward-facing lens release button at the left of the 50mm f/1.8 EF Canon lens while you turn the barrel about 60° counter-clockwise, then lift the lens off. The EF (electronic signal transfer system) stainless steel bayonet mount measures a huge 54mm in diameter and it's firmly affixed to the diecast aluminum main body with four hefty screws. At the bottom of the mirror box, just inboard of the mount itself, is an array of eight spring-loaded gold-plated contacts, which mate with seven flat gold-plated contacts on the backs of the lenses (presumably one contact is reserved for future use). The only mechanical linkage, if you can call it that, is a tiny spring-loaded button at 3 o'clock position in the mount, which retracts when you push in the lens release button or mount a lens. It's a simple switch, which turns on the camera's AF and exposure circuitry when the lens is in place. In effect, the Canon EF mount is the first totally electronic mount on a 35mm SLR.

But if there are no mechanical pins, linkages or keyways on either body or lens, how does the camera physically focus the lens and stop down the lens diaphragm? Answer: By sending signals to the AFD (Arc Form Drive)—a modified, brushless, Hall effect AF motor arranged in the form of an arc—and the EMD (Electro-Magnetic Diaphragm) motor built into most Canon EF lenses. Instead of putting the focusing motor and aperture control system in the body as virtually every other manufacturer has done, Canon's engineers developed tiny, high-efficiency micromotors that fit inside the lens barrel without altering its traditional round shape. The motors are so small and light that the size and weight of EF lenses are virtually no greater than those of competitive motorless lenses with comparable speed and focal length.

Claimed advantages of Canon's system: Motor characteristics more closely matched to each lens, elimination of linkages for improved energy efficiency, decreased inertia of smaller parts, providing faster, more accurate focusing and f/stop setting, and quieter operation, especially focusing. Whether



## What's New At a Glance: Canon EOS 650



or not all these claimed benefits will be evident in comparing the EOS to its rivals is an open question. However, the camera's focusing and exposure accuracy are commendable, and it's definitely the quietest-focusing AF SLR we've tested.

Special miniature motors are far from the only high tech elements to be found in Canon's unique autofocus system. The most basic is the AF sensor in the body, which is not the usual CCD array but a Canon-developed, Canon-manufactured sensor called BASIS (for Base Stored Image Sensor). While the BASIS system focuses by means of phase detection just like CCD-sensor systems, the BASIS sensor contains 48 cells, each with its own individual amplifier circuit. So, instead of reading the amplified output of a chip as a single electronic value, each element of the chip can be individually monitored and compared with the overall reading. Claimed advantage: Greatly improved signal-to-noise ratio resulting in noticeably better low light performance—down to EV 1 at ISO 100 (see chart on page 8 for our test results).

Yet another technological coup is the computing power built into the EF lenses themselves. While AF lenses from other makers incorporate ROM (read only memory) chips containing fixed information such as basic lens specs, Canon EF lenses have, in addition, two microprocessors on board, one for power control, the other for calculating and control of lens functions. This system permits two-way communication between the body and the lens. And Canon claims it enables more complex information to be processed more swiftly, resulting in quicker focusing, especially under adverse conditions.

Although the EOS 650 offers an impressive number of modes and controls—indeed, few SLRs are endowed with more user-selectable options—they are so logically set forth that they're easy to learn and hard to forget once you've used them. To set the most basic operational modes, turn the main switch, a knurled knob to the left of the eyecup, to one of four click-stopped set-

tings. To select exposure modes or compensation, maintain finger pressure on the Mode or Exp. Comp button to the left of the pentaprism housing while turning the knurled electronic input dial (it's behind the angled electromagnetic shutter release atop the hand grip) with your right index finger until the proper mode indication appears on the large, top-mounted LCD panel. Less commonly made settings (e.g. mid-roll rewind, AF and film wind modes, manually keyed ISO and battery check) are made by pushing buttons concealed behind a hinged flap on the back of the camera, near the bottom. Once you push the button(s) (except the rewind button, which initiates power rewinding the instant you press it) you have 8 sec. to turn the electronic input dial to effect the setting you want, which is then displayed briefly on the LCD panel.

Now that you understand the main control systems let's run through the options they provide. With the main switch at L (lock), all power circuits are turned off, except that the LCD panel still displays the frame number and film loaded status. Turn the dial about 80° counter-clockwise to the green rectangle detent and you're in full auto mode, the basic setting for those who "just want to take pictures" or don't want to figure out how to get out of whatever mode they're in. It's the equivalent of the return-to-basic-settings or "panic button" found on other AF SLRs. Select full auto and you'll automatically be in single shot AF mode, programmed exposure mode, and single shot film-wind mode with the beeper turned on. Unlike "reset buttons," when the EOS is in this mode your manual choices are somewhat restricted—more on this a bit later.

The electronic beeper sounds two short beeps the instant the AF system has attained proper focus (and a series of longer beeps as a camera shake warning at slow shutter speeds—below about one over the focal length of the lens in use). The exposure program is an intelligent program because the lens remains wide open as the light level increases until a shutter speed of one over the focal length of the lens in use (or up to

0.5 EV below that) has been attained.

In the full auto mode the LCD panel shows a P at the top for program mode, One Shot in the film-wind box, S (for single shot) in the AF mode box, plus frame number and film loading status. If you set the focus mode switch near the top of the lens barrel to M (manual focus) instead of AF, the focus mode box on the LCD displays M.FOCUS and the beeper remains silent or emits a distinctive uneven beep when you press the shutter release partway in to focus. Slide the switch to AF, bring the camera to eye level and press the very smooth shutter release until you feel slight resistance and the camera will focus on whatever is in the clearly marked AF "brackets" in the central area of the finder screen (presuming it has sufficient detail and contrast and the camera-selected aperture and shutter speed (both in half stops if necessary) are displayed in yellow-green transilluminated LCD digits below the finder screen. To the right of this panel is a round LED of the same color that lights continuously when the subject is in focus or flashes rapidly if the subject cannot be properly focused.

When you're in the full auto mode, you cannot select Servo (continuous) AF, C (continuous) film wind, partial (limited central area) metering, exposure compensations or any other mode except for manual focusing if needed—a good safety feature for tyros. The finder readouts are outstanding—clearly visible in any light, or in total darkness for that matter. They remain on for about 8 sec. when you touch the shutter button, and the numbers will change to suit the lighting conditions if you move the camera without touching the shutter release. However when you press the release partway in with the camera set to "One Shot" AF, the camera-selected exposure will be locked in the instant the camera attains the correct focus, as long as you maintain pressure on the release. This occurs in any exposure or film-wind mode and it allows you to recompose with the in-focus subject off center. Follow through with your shutter finger to take the shot.



## 35MM Single Lens Reflex

The two remaining settings on the main power switch are A (on, beeper off) and a "dot-in-brackets" setting (on, with beeper enabled). To set either, turn the dial clockwise off L to the appropriate detent. If you've just been in full auto mode, you'll now be at the same basic settings when you switch to A or Beep, but at either of these positions you can now select the full range of exposure, metering, focusing, and film-wind modes. Press in the Mode button while turning the Electronic Input dial clockwise and its successive detents correspond to Tv (time value or shutter-preferred autoexposure), Av (aperture value, or aperture-preferred AE) and DEPTH, the automatic depth-of-field-setting mode (which we'll get to a bit later)—all of which are displayed atop the LCD panel. Turn the input dial one detent counter-clockwise off P and you're at M, the metered manual exposure mode. When you're in any of these modes (except DEPTH), open the button compartment on the back of the camera and you can change focusing and film wind modes or manually change ISO/ASA film speed settings by pressing the appropriate buttons and turning the input dial. Only the black battery check and mid-roll rewind buttons are operable in all modes except L.

To switch to servo AF, for example, press the yellow AF button and all LCD panel displays except the focus mode box turn off for about 8 sec. If, during that time, you turn the input dial, the display will switch from ONE SHOT to SERVO alternately as you turn the dial to successive detents. In One Shot mode the shutter will not fire until proper focus has been attained unless the lens is set to manual focus. Once the green focus OK LED in the finder lights, the beeper sounds two short beeps and the exposure is locked in as mentioned. In Servo mode, the camera will continuously focus to track a moving subject and you can release the shutter at any time, even if proper focus has not been attained. The exposure is now determined at the instant before the shutter fires, when you press the shutter release all the way in to take the shot.

In bright light in Servo mode, the EOS 650 autofocuses with commendable speed. For example, when you're using the normal lens, it can track a jogger moving at "average speed" toward the camera and keep him in focus until less than half his body fills the frame. We found the performance to decrease only marginally in lower light, providing the moving subject has sufficient contrast and detail. As expected, autofocus on a moving subject becomes more difficult as its speed increases, its distance to the camera decreases, and as its angle to the film plane approaches 180°. Nevertheless, the EOS' on-film performance with really fast subjects like auto racers and base runners is remarkably good, certainly better than average, compared to other AF SLRs. So long as there is sufficient depth of field to cover minor focusing errors, the servo mode will provide reasonably sharp focus with all but the most difficult subjects, and will certainly outperform most humans. When you consider that the EOS focuses its 50mm f/1.8 lens from infinity to 18 in. in 0.56 sec. and its 35-105mm from infinity to 34 in. in 0.85 sec. at the 105mm setting, this should come as no great surprise.

To select film-wind modes press the blue button in the button compartment next to the

yellow AF button and all LCD readouts turn off except those in the film-wind box. You now have 8 sec. to turn the input dial, which sets S (single frame), C (continuous run) or a clock symbol (for self-timer) at successive detents. In S mode the shutter will release once and the motor will advance the film one frame each time you press the shutter release. In C mode you can shoot bursts at 3 frames per sec. if you keep the shutter release pressed in. You'll get a slower framing rate if the shutter speed you're shooting at is too slow (say, below 1/30 sec.) or if you're in single shot AF mode, and the camera must achieve proper focus before the shutter fires. In bright light, with a moving but focusable subject kept within the AF frame, your framing rate will typically be about 2 fps.

One rather strange feature of the C mode is that all finder displays go out the instant the shutter first fires and remain out for the entire sequence until you let go of the shutter release and press it partway in again. If the light changes, or if you point the camera in another direction while firing continuously, the camera will continue to adjust to provide the proper exposure—as you can readily see by monitoring the LCD panel—but you'll get no indication of this in the finder. What's more, the focus OK LED stays out, and the beeper remains silent even when a non-hand-holdable shutter speed is automatically selected. We can appreciate that the most important thing when shooting sequences is to keep the subject properly framed in the finder, and distractions such as beeps and flashing LEDs can prove annoying, but we see no practical reason for depriving sequence shooters of exposure readouts.

Those little buttons in the hinged-cover compartment let you do two more things in conjunction with the LCD panel—manually key in film speeds and check the battery. To set the ISO of a non-DX cartridge or to override the DX speed and set one of your own, press the yellow and blue buttons simultaneously and only the set ISO will appear on the LCD panel. You now have 8 sec. to turn the input dial to set film speeds from ISO 6-6400 (DX settings cover ISO 25-5000). To check the condition of the 6-volt lithium battery pack, press and hold in the black battery check button on the extreme right and check the LCD panel, which will display BC above the AF mode box and one or more dashes at the bottom, toward the right. Three dashes mean you've got sufficient battery power, two mean you should have a fresh battery handy, one means that battery exhaustion is imminent, and a flashing dash or no display at all means you should replace the battery immediately.

Changing the battery is a pretty simple procedure if you have a coin (a quarter will do nicely). Turn the coin-slotted fastener on the right-hand side of the grip about four turns counter-clockwise and lift the grip off (notice that the shutter button and input dial surround above it are integral parts of the body). You can now see the battery nestled lengthwise in its little compartment at the bottom of the main body. Push the orange plastic retainer up out of the way and tilt the camera so that its right side points downward and the battery will slide out. The new battery slides in just as easily, but it will fit wrong way round. Make sure to install it with its silver terminals pointing inward, toward

## GENERAL PERFORMANCE

| Checkpoints                            | Our Standard                                                                                                       | As Tested                                           |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <b>FINDER:</b>                         |                                                                                                                    |                                                     |
| Apparent viewing distance              | Between infinity and 20 in. (0.5m)                                                                                 | 39 in. (1.0m)                                       |
| Apparent distance of information scale | Between 79 in. (2.0m) and 26 in. (0.7m)                                                                            | 39 in. (1.0m)                                       |
| View area compared to film area        | Vertically and horizontally more than 90%, less than 100%                                                          | Vertical: 93%<br>Horizontal: 94%                    |
| Parallax error compared to film        | Vertical: 0.9mm<br>Horizontal: 1.0mm                                                                               | Vertical: 0.2mm (down)<br>Horizontal: 0.05mm (left) |
| Focusing accuracy at maximum aperture  | Within depth of focus                                                                                              | No discrepancy                                      |
| Image magnification                    | 0.80X ± .1X                                                                                                        | 0.82X                                               |
| <b>PICTURE SIZE:</b>                   | 24 ± 0.6mm X<br>36 ± 0.9mm                                                                                         | 24.3mm × 36.4mm                                     |
| <b>SHUTTER:</b>                        |                                                                                                                    |                                                     |
| Curtain travel evenness                | ± 0.33 stop                                                                                                        | 0.01 stop                                           |
| Insulation from sync                   | More than 7 megohms                                                                                                | Infinity                                            |
| Sync contact efficiency                | More than 60%                                                                                                      | 83% (hotshoe)                                       |
| Sync delay time                        | X: within full opening                                                                                             | Okay                                                |
| Shutter curtain bounce                 | Not allowed                                                                                                        | None                                                |
| Self-timer delay                       | 7-15 sec.                                                                                                          | 10 sec.                                             |
| <b>CAMERA NOISE:</b>                   | 71 dB(a), quiet for a motorized AF SLR                                                                             |                                                     |
| <b>CAMERA SIZE:</b>                    | Body: 5¾ in. wide × 4¾ in. high × 2¾ in. deep (147 × 106 × 65mm)<br>Lens: 1½ in. long, 2½ in. diameter (41 × 67mm) |                                                     |
| <b>WEIGHT:</b>                         | Body: 1 lb. 8¾ oz. (706g) with batteries<br>Lens: 6½ oz. (185g)                                                    |                                                     |



the back of the battery compartment, and to push it in against spring tension until the retainer comes down to hold it in place; then replace the grip. Speaking of grips, Canon offers two alternatives to the standard GR30 grip—the GR20, which is the same size but has a remote control terminal, and the GR10, a large-size, no-terminal grip for big hands.

All the exposure modes available through the A or Beep main switch settings operate in a most straightforward and logical way. In P mode the camera automatically selects aperture and shutter speed and reads them out simultaneously on the LCD panel for about 8 sec. if you press the release partway and then let go. If the lighting or subject changes during this period, the readouts change to indicate the proper camera-selected exposure. If the maximum aperture and slowest shutter speed (30") numbers in the finder blink simultaneously, the camera is warning you of potential underexposure, and you should use a tripod or flash, or increase the illumination. If the fastest shutter speed (1/2000 sec.) and minimum aperture numerals blink, the camera is warning you of overexposure and you should use an ND filter or move the subject to a darker location if possible. If the beeper is turned on, long beeps will signal underexposure, but not overexposure.

Press the mode button and turn the input dial to select shutter priority (Tv) mode and the shutter speed will automatically be set to 1/125 sec. Now let go of the mode button and turn the input dial to select any shutter speed (successive detents will set shutter speeds in half stops from 30–1/2000 sec.). The camera will automatically set and display the proper-exposure aperture (also in half stops) as soon as you partially depress the shutter release. The display will remain on in the finder and on the LCD panel for about 8 sec. and change with changing lighting conditions, but the reading locks in the instant proper focus is attained in the One Shot AF mode. If the exposure display in the finder remains continuously lit, you'll get the proper exposure. A blinking maximum aperture indicates underexposure (select a slower shutter speed), while a blinking minimum aperture indicates overexposure (select a faster shutter speed). The shutter speed digits don't blink and the camera shake beeper doesn't sound when you're working in Tv mode.

Switch to Av (aperture priority) mode and the camera will automatically be set to f/5.6. Now turn the input dial and you can select any aperture (in half stops) possible with the lens in use. The camera will now set and display the proper-exposure shutter speed when you partially depress the shutter release in the same manner that camera-selected apertures are shown in the Tv mode. As you'd expect, underexposure is now indicated by a blinking 30" speed in the finder and overexposure is shown by a blinking 2000. When the shutter speed falls below about one over the focal length in use, the slow shutter warning beeper sounds if it's turned on.

Unlike most other multi-mode SLRs, the EOS 650 does not provide any in-finder indication of the autoexposure mode you're in. If you've just set one of the three AE modes, you obviously know what it is, and if you want to refresh your memory, just glance at the LCD panel. However, switching AE

modes with the camera at eye level is one convenience most EOS owners won't avail themselves of unless they have very good memories. At eye level it's pretty hard to tell whether you're in Tv or Av mode by just turning the input dial and observing the readouts—both apertures and shutter speeds change in either case.

You'll love the metered manual mode, so long as you don't mind selecting your shutter speed first and metering the proper-exposure aperture second. To select M mode, press the Mode button while you turn the input dial until M appears in the upper left-hand corner of the LCD panel, and, praise be, in the finder LCD panel as well, to the left of the digital readouts. The camera will now be automatically set to 1/125 sec. at f/5.6. Now turn the input dial to the left or right to select slower or faster shutter speeds respectively (in half stops), bring the camera to eye level, and press the M-labeled (manual metering) button located on the left-hand side of the camera about an inch below the lens release button. At this point the shutter speed digits disappear and are replaced by a CL, an OP or an OO. The OO symbol indicates that the aperture displayed will provide the correct exposure at the shutter speed you've selected. CL means you must close down the aperture (by keeping the M button depressed and turning the input dial clockwise) to obtain the correct metered exposure. OP means that you've got to open open it up (by turning the same dial in the opposite direction) until the OO appears. Using this system you can manually meter the exposure to an accuracy of 2½ stop (the AE modes will get you to within 1/4 stop or less in most cases according to our lab tests). However, if the light or your shooting angle changes you must check your exposure by pressing the M button just before you take the shot, then letting go of the M button before you press the shutter release. The shutter won't fire when the M button is depressed. Set M exposure mode along with the C (continuous) film-wind mode and the finder readouts will still go out after the first exposure, but the exposure will remain locked in at your initial manual setting.

Up to this point there have been few surprises, but now we get into the only other mode that's clearly indicated in the finder—the EOS 650's unique depth mode. Canon calls it an exposure mode, but as you'll soon see it's a lot more than that. To select Depth mode press the Mode button and turn the input dial until the word DEPTH appears at the upper right-hand corner of the LCD panel. Now compose your subject in the finder and determine which near and far points you wish to be in sharp focus. Center the AF frame over the foreground (closest subject area) and press the shutter release partway to focus. The camera will now focus, the focus OK LED will light, the beeper will beep if turned on, and DEP 1 will be displayed both in the finder and top LCD panel. Now follow the same procedure but center the AF frame over the background (most distant) area you wish to record sharply and DEP 2 will appear in the displays. Partially depress the shutter a third time and something quite remarkable happens. The camera automatically focuses to the optimum in-between distance to maximize depth of field, sets the aperture that will render objects at the near and far distances sharply, and sets the corresponding proper-exposure shutter speed. Now all you have to

do is press the shutter release all the way in to take the shot. Of course even the EOS cannot perform miracles; if your two focus points are widely separated, especially in fairly dim light and/or with slow film, you may get the right aperture and shooting distance to cover your intended depth of field, but at too slow a shutter speed to hand-hold. Underexposure and overexposure in the Depth mode are indicated as in the P mode, by both sets of digits flashing. If it isn't possible to get the distance range in focus at the smallest aperture, that value will start to blink. However if you elect to shoot anyway, you will get the best results possible under the shooting conditions. You can even use Depth mode to minimize depth of field by focusing on two identical or very close distances before you shoot.

Incidentally, Canon's Depth mode presumes a circle of confusion of 0.03mm. Actual depth of field is subjective depending on the viewing conditions. With bigger enlargements, effective depth of field decreases and you might have to manually select smaller apertures than the Depth mode provides automatically. Regrettably, the Depth mode cannot be used in flash photography. If you set Depth mode, Canon dedicated flash units will automatically override it as soon as they recycle. Presumably the main reason Depth and Flash modes are incompatible is that objects much closer than the optimum focus point would be overexposed and those much farther away would be underexposed.

Now that we've got the 650's many exposure and operating modes pretty well under control, let's examine its metering patterns. The EOS provides through-the-lens (TTL) metering at full aperture only, using an SPC cell located above the pentaprism housing (there's another cell for off-the-film TTL flash metering in the base of the mirror box). The main meter cell is divided into six parts to provide a choice of two metering patterns. The standard metering pattern for all exposure modes is what Canon calls evaluative metering. This is a multi-pattern system that combines elements of the AMP system in the Nikon FA and the ESP system in the Olympus OM-PC. In Canon's system the field is divided into six zones (diagram and test results, original reports). The six areas include a central circular zone, a band around the central zone, and four equal-sized areas around the perimeter of the screen. The system measures luminance in each of these areas, analyzes their levels and distribution to determine such variables as subject size and brightness, normal or backlit scene, and then sets the exposure using specially developed algorithms based on analyzing thousands of actual photos and corresponding exposures.

In the vast majority of cases Canon's evaluative metering system delivers the "correct" exposure, or at least one that most people will find pleasing. It compensates effectively in many tough metering situations, including the classic backlit portrait, but it isn't perfect. Based on our extensive field tests, we'd place its overall accuracy at about 96%. This compares favorably with competitive multi-pattern systems but is not markedly superior to the best of them.

For most pictures, evaluative or multi-pattern exposure systems work very well, and they can eliminate a lot of drudgery, letting you concentrate on the action or on the com-



## 35MM Single Lens Reflex

position. But when you need maximum creative control of dramatic lighting or wish to record unconventional effects, you've got to know precisely what your metering system is doing. That's why most multi-pattern-metering SLRs incorporate a second, user-selectable metering pattern that lets you take full control of final results.

Canon calls the alternative metering option in the 650 "partial metering" and advises you to use it when there is a large difference in brightness between the main subject and the background; when shooting a stage performance, for example. Basically, partial metering is a variety of spot or limited area metering, with virtually all of the meter's sensitivity concentrated in the central 6.5% (or 8mm) of the picture area, which is clearly defined by a very thin black circle circumscribing the AF frame in the finder (see finder diagram, original report). Partial metering can be used in all exposure modes except full auto (green rectangle) position—a sensible limitation intended to keep novices out of trouble.

To use partial metering, place the subject or subject area you wish to meter within the partial metering circle in the finder and, while pressing the shutter button partway in, press the partial metering button (it's at the topmost portion of the thumb rest on the back) with your right thumb. This feels quite comfortable and natural, but requires a deliberate action. A red asterisk now appears in the finder display indicating that the partial metering mode and AE lock are on. You can now remove your finger from the partial metering button; the original metered exposure value remains locked in as long as you keep the shutter button partially depressed (except in Depth and Flash modes) and you're free to recompose the picture while holding the reading. Just press the shutter release completely to take the shot. You can even shoot sequentially while retaining your original reading, so long as you keep the shutter release partially depressed after each exposure—a useful technique when shooting sequences in unvarying lighting conditions.

We found partial metering to be very convenient and effective in dealing with tricky lighting conditions, or when we wanted to experiment creatively with exposure. For instance, creating high key effects or silhouettes was almost as easy as shooting on auto pilot, and by zooming to tele to meter and back to wide or normal to take the shot we could get, in effect, true spot metering. As with any spot metering system, it takes a knowledgeable photographer to get the most out of it, but we were delighted to find this sophisticated option built into a "broad spectrum" autofocus SLR.

Another useful feature for serious photographers is the 650's wide-ranging exposure compensation system. Hold in the EXP. COMP button (it's about 1/2 in. behind the mode button) and all indications on the LCD panel disappear and are replaced by 0.0 and a  $\pm$  symbol. Now, while holding in the button, turn the input dial clockwise and you can dial in additional exposure in half-stop increments (all denoted with a +) up to 5 full stops; turn the dial in the opposite direction and you can select up to 5 stops less than the normal exposure (denoted by a -) in the same way. When you let go of the compensation button the original LCD display returns, but if you've dialed in any

compensation at all in either direction a  $\pm$  symbol appears as a warning on the LCD panel and in the viewfinder, to the right of the aperture readout. To find out how much compensation you've set, just press the button and glance at the LCD. We think this system is well nigh perfect, and persnickety types who insist on setting exposure compensation in 1/3-stop intervals can always resort to the ISO settings.

Yet another device we were pleased to find on this electrified marvel is a depth-of-field preview button, which is really nothing more than a switch for the electromagnetic diaphragm motor in the lens barrel. The button itself is found on the left, front side of the body, in between the lens release button and the manual metering button. Push it in while holding the shutter button partway in and you'll hear a quiet "tick" as the lens stops down to working aperture. If the camera-or user-selected aperture is about f/5.6 or smaller, the finder will darken noticeably and you will have a better idea (but not a perfect one) of whether objects before or beyond the point of optimum focus will be sharply rendered.

After all this tech talk, perhaps you're wondering what shooting with such a "complicated" camera is really like. Happily, the genius who came up with Canon's slogan, "So advanced it's simple," could have been talking about the EOS 650.

Film-loading procedure is what we've come to expect from motorized SLRs. Push the release button while you slide the back-opening tab on the camera's left side and the back pops open. Swing it to the right and you'll see that the film compartment on the left incorporates six spring-loaded, gold-plated DX contacts. (Note in passing that the back is easily removable and that there's a vertical array of eight flat, gold-plated contacts to the right of the take-up spool that mate with Canon's simple Quartz Data Back E or super-sophisticated Technical Back E that has its own optional keyboard unit.) Now hook the flat end of the film cartridge under the rewind shaft, push the bottom end forward until it seats, pull the film leader across a metal plate over the sprocket shaft until its end coincides with the orange mark (make sure you can feel the sprocket teeth through the film perforations and that the film lies flat) and close the back. The instant you snap it shut, the motor whirs discreetly, and film-winding graphics move along the bottom of the LCD panel as the ISO setting is briefly displayed. If all is well, the film loading symbol stops moving, the ISO disappears, a "1" appears in the frame number box, and the LCD displays all mode settings. Non-DX cartridges are keyed in at the last used ISO setting, and you can display your set ISO at any time by pushing in the yellow and blue buttons in the little covered button in the back.

Now turn the main switch to the full auto (green rectangle) position, or select your exposure mode after turning to the A or Beep settings, confirm that the sliding tab atop the lens is set to AF, and you're ready to shoot. Bring the camera to eye level, center your subject in the AF frame and lightly press the comfortably angled shutter button and the EOS will focus with a quiet, high-pitched "zzzzt." The instant the camera attains correct focus the OK LED lights and the beeper emits two short beeps (if enabled). Just follow through with your finger on the com-

mendably smooth shutter release to take the shot.

There's nothing remarkable about this basic procedure, which is common to virtually all AF SLRs; it's how the EOS does it that's significant. To begin with, the camera is luxuriously comfortable to hold. Its rounded contours fit your hands with near perfection, especially the grip and thumb rest, which are superbly shaped, with just the right touch of softness imparted by their rubberized coverings.

The EOS is also beautifully balanced and rather light for its size. Evidently Canon's philosophy of "mass centralization," essentially concentrating most of the camera's weight in the central, bottom portions of the body, is quite effective. The EOS handles extremely well with either of our test lenses, the light 50mm f/1.8 and the somewhat heavier 35-105mm f/3.5-4.5. Combine this degree of handling ease with the 650's very smooth shutter action and well-damped mirror and you have a camera that can effectively be hand-held at somewhat slower speeds than many other SLRs we've tried.

Good ergonomics extend to control placement as well. We've already extolled the logic of the controls' functions and the placement and action of the shutter release, but the location of the manual metering, depth-of-field preview, and spot-metering buttons are also well thought out, and the electronic input dial falls neatly under your right index finger just where you'd expect to find it. Pressing the mode or compensation button with your left index finger as you turn the input dial with your right feels very natural. Only the main switch is a bit awkward for right-handers, but it's usually used only at the beginning and end of a shooting session to select the basic mode of operation or to turn the camera on and off.

The way in which the EOS autofocuses is also commendable. It's swift and smooth with very little tendency to "hunt," even in low light or with fairly low-contrast subjects, so long as there is adequate detail. Whether or not it is actually faster than competitive AF systems under all conditions will have to await a true side-by-side comparison test, but we can affirm that the EOS definitely focuses as well as any other AF SLR we've tried, and better than some. It is also the equal of any other AF system in low-light performance, but does not appear to be markedly superior to its leading competitors.

To date, no AF system approaches perfection and the EOS has trouble when subjects having little or no contrast are centered in the AF frame, in extremely low light (unless a dedicated Canon Speedlight supplies a near-IR focusing pattern) and with subjects having horizontal patterns, such as window blinds. Highly reflective or extremely backlit subjects occasionally caused the EOS to "hunt," as, of course, did subjects that move so fast you can't even keep them centered in the AF frame. Despite these genuine deficiencies, you will not find any other current SLR that outperforms the Canon EOS 650 in overall autofocus ability.

Actually, encountering a subject that must be focused manually lets you experience one of the 650's nicest features—its manual focusing system. Unlike most other AF SLRs' lenses, the EOS' focusing rings don't turn as the camera autofocuses; only the inner barrels rotate. You must still keep your fingers



clear of the front of the lens, which moves in and out as it turns, but you can't snag your fingers on a rotating focusing ring as you can with other AF SLRs. To minimize this possibility, other manufacturers have made the manual focusing rings on their AF lenses very thin, and placed them near the front of the lens. A few (notably Olympus) have eliminated them completely, relying on power focus controlled by a switch on the body.

Because the focusing rings on Canon EF lenses need to rotate only when you slide their switches from AF to M and physically turn them, they could be made much wider, more heavily knurled, and of a grippier material for easier manipulation. They also provide smoother manual focusing action than most other AF lenses, and can be focused very swiftly on the EOS' bright, very contrasty screen. Incidentally, while the 650's finder magnification is slightly lower than average at 0.8X, it provides greater eye relief than most SLRs (its eyepoint is 19.3mm) and virtually the entire frame can be seen by most eyeglass wearers.

No analysis of the EOS 650 would be complete without explaining its truly remarkable flash system. A glance at the camera's five-contact dedicated hot shoe suggests that something fascinating is afoot and it most certainly is. The EOS system provides two-way communication between flash and body, automatically sets the flash for the proper ISO with DX film, and for the lens and focal length in use. Both the Speedlite 300EZ and 420EZ introduced with the camera provide automatic internal zooming, and Advanced TTL (A-TTL) operation, which automatically sets the flash sync speed (upon recycling) and the correct aperture value based on overall scene illumination and subject illumination. These are ordinarily determined by a near-infrared preflash. The TTL system meters the light reflected from the film surface and permits automatic fill-in flash under a wide variety of ambient lighting conditions.

Since most of our flash pictures were shot using the more powerful and comprehensive 420EZ, we'll concentrate on this model. Basically it's a medium-sized shoe mount unit in smooth black polycarbonate with rubberized accents to match the EOS. Its forward-tilted body and sleekly conservative styling also complement the camera very nicely. At the top is a tilting, swiveling head with detents at the 60°, 75°, and 90° tilt and forward-facing positions, and marked click-stops at 60°, 75°, and 90° swivel positions to left and right (for side bounce). Push up the "bounce latch" at the back of the head and you'll find that it can be swiveled up to 90° clockwise, and a full 180° counterclockwise. No release is needed to tilt the head.

On the front of the 420EZ, below the head, is a large, round sensor surrounded by a nearly rectangular panel that serves as an infrared light emitter for flash exposure determination. Near the bottom, in front of the foot and locking collar, is a trapezoidal AF Auxiliary Light Emitter that puts out a near-infrared pattern that allows the camera to autofocus in total darkness over a 3–26 ft. range. On the unit's left-hand side is a slide-to-open, hinged battery compartment for four common AA cells of any kind (preferably nicads or alkalines).

Undoubtedly the most interesting part of the 420EZ is its back, which features a large LCD panel, an array of five clearly labeled

buttons, and, at the bottom, an on-off switch on the right and a ready light on the left. Even before you mount the unit on the camera you can have lots of fun with it. Slide the white switch from O to I, uncovering a red dot, to turn the flash on. The LCD panel will now display A-TTL, A Zoom and 35mm, and the ready light will turn green in about a second and red several seconds later. Push the ready light in and you can fire a test flash.

What is the meaning of all this? It's quite simple actually. A-TTL means you're in the aforementioned A-TTL mode and the camera/flash combo will set everything for you automatically, and provide automatic fill-in flash when needed, even if you decide to choose your own aperture or shutter speed. The A Zoom means that the flash head will automatically zoom internally to provide the appropriate coverage for the lens or focal length in use as soon as you mount the flash on the camera, turn it on and touch the shutter button. This focal length is read out on the right side of the flash's LCD. Push the Zoom button on the right and the display will change to M Zoom and indicate coverage for the widest possible focal length, 24mm. Keep pressing the M Zoom button and a built-in motor will move the flash head incrementally and the display will change to 28, 35, 50, 70, then 80mm, the longest focal length setting. Press it again and you're back in A Zoom mode at the 35mm setting.

What about that two-colored ready light? It's another ingenious system that provides some of the rapid-fire advantages of lithium batteries in a flash powered by conventional AA cells. You'll get a quick, low-voltage, rapid-fire flash in 0.2–1.5 sec. at 1/2–1/6 power (with fresh alkaline batteries) when the ready light turns green and a full-powered flash if you wait from about 3–11 sec. longer (depending on how much power was used for the last shot) at which point the ready light turns red.

Just to the left of the zoom button is one marked "light." Press it and the entire LCD is illuminated in the jazzy blue radiance of an electro-luminescent display. The light stays on for about 8 sec., long enough to let you see and set your flash modes in darkness. Another thing that automatically turns itself off is the flash itself. Leave it on accidentally and it shuts itself off in about 5 min. to save power (providing you haven't touched the camera's release or changed a flash setting in the interim). Thirty seconds before it does so, the LCD display flashes in warning.

In the middle of the five-button array is the Sync button. Press it in with the unit turned on and you'll get a tiny three-triangle display right under the focal length digits. This indicates that second curtain flash sync will be made automatically. Ordinarily an electronic flash fires the instant the first shutter curtain opens completely. By waiting to fire the flash until just before the second or closing shutter curtain starts running, the flash still clearly illuminates the subject, but it creates a trailing image of any luminous object that moves across the picture field while the shutter is open. For example, use a slow shutter speed with second curtain flash sync as your subject swings a flashlight, and the resulting trail of light will appear opposite to the direction of subject motion, which looks much more natural in the picture.

The next button to the left is labeled MANU, and when you press it, you're set for manual flash. The LCD display now reads

M1/1, which denotes manual at full power. Press the button again and it will read M1/2. Keep pressing it and you can select 1/4, 1/8, 1/16 and 1/32 power before you get back to full power. The last button is marked A-TTL and it's for getting you back to Advanced TTL mode from any other mode.

If you think you've run out of options just because you've run out of buttons, guess again. The 420EZ's most dazzling trick is obtained by pressing the MANU and SYNC buttons simultaneously, as suggested by the Multi-and-brackets mark centered under both buttons. When you do so, the previously described manual display appears along with MULTI, 1HZ. You are now in the Stroboscopic Flash mode.

Yes, this is one electronic flash that can truly be called a strobe. If you now press the Sync button repeatedly, the display will change from 1HZ to 2HZ—all the way up to 5HZ, then back to 1HZ. This is the number of flashes per sec. you will get. No, you can't get five flashes per sec. on full power (try 1/8 power), you can't get an unlimited number of stroboscopic flashes during a long exposure even at 1/32 power (it's 244 max), and the strobe mode is strictly a manual exposure mode (consult the 420EZ's manual for details). However, you can get true stroboscopic multi-image effects of "disassembled motion" a lot more easily than Dr. Edgerton did, providing you choose a highly reflective subject and a dark or distant background and use a tripod. It's not as easy as falling off a log and it's not a capability you'll use every day, but it definitely works and it sure is nifty.

All right, let's slide the five-pin 420EZ into the EOS 650's five-contact dedicated hot shoe and see what else it can do. For starters, if your subject is too far away for the AF auxiliary focusing light, the focus OK LED in the finder blinks, warning you to move closer. In A-TTL flash and programmed AE modes, the flash chooses the proper-exposure aperture and flash sync shutter speed (up to 1/125 sec.), and both these values blink in the finder if the subject is too far away. With daylight fill-in flash the minimum aperture number will blink if the background will be overexposed but the main subject will still be correctly exposed.

When the camera is set to shutter-priority (Tv) mode, you can choose any shutter speed you wish from 30 sec. to 1/125 sec. (the camera will override faster speeds) and the flash will automatically set the correct autoflash aperture based on film speed, subject reflectivity, etc. The beyond-range warning works as it does in P mode, but the maximum aperture now blinks when the background will be underexposed, and the minimum aperture blinks if it'll be overexposed. The minimum aperture may stop blinking if you select a faster shutter speed, and the main subject will be properly exposed in any case.

In aperture-priority (Av) mode, you can select any autoflash aperture you wish—useful for fill-in flash portraits and flash sync at slow shutter speeds (make sure to check your shutter speed readout as the camera shake beeper won't sound). As before, if both shutter and aperture digits blink in the finder, it's an underexposure warning and you must move closer. If the 30 sec. digits blink, A-TTL is impossible and the background will be underexposed (choose a larger aperture or move closer). When the



## 35MM Single Lens Reflex

flash sync shutter speed blinks, the background will be overexposed. In either case, the flash will revert to normal TTL and the main subject will be correctly exposed.

Naturally, you can also use the 420EZ in the camera's manual metering mode. In this case the flash's LCD will read "TTL" and the exposure will not be balanced between the main subject and the background as it is in A-TTL mode—only the correct exposure for the main subject can be obtained. You can now select whatever aperture you wish and shutter speeds up to 1/125 sec. Press the shutter button lightly and your autoflash shooting distance range in feet appears at the bottom of the flash LCD panel. The automatic shooting distance range changes according to the flash head position, film speed and set aperture and goes up to 99 ft. (after which point a delta appears). If correct exposure is impossible, the maximum shooting distance blinks.

Now remember that the flash also has its own manual mode that lets you set fractional power. Set this mode and choose your flash intensity, set the camera to manual exposure mode and, yes, you can still determine the correct flash exposure even at fractional power settings. Here's how. Choose any shutter speed up to 1/125 sec., set the camera's AF mode to One Shot, focus on your subject, and read the distance off the lens' distance scale. Now press the camera's manual aperture M button while turning the input dial and note the aperture and distance readouts appearing on the flash's LCD. When the displayed distance nearly equals the subject distance you just read off the lens, you've got the correct exposure. Obviously this method isn't the last word in convenience, but it's pretty amazing nonetheless.

In actual use the 420EZ is every bit as simple to use as it is complicated to describe. We were particularly enamored of its bounce performance, which was extremely good in both A-TTL and TTL modes with no need for calculations. The instant you tilt or swivel the flash head, the focal length indications disappear from the LCD panel and a cute little diagram of a bouncing flash appears in the lower left-hand corner. In all autoexposure modes, you get A-TTL flash when possible, and when you bounce or tilt, the main flash head fires a low-intensity flash to monitor subject reflectivity. It is difficult to determine whether this alone accounts for the unit's excellent autoflash performance in bounce flash photography, but it probably helps.

Of course not even this incredibly versatile and cleverly designed shoe mount flash is perfect. We did get a small but significant percentage (about 3%) of imperfectly exposed flash pictures—primarily overexposed close-up portraits in the 2–4 ft. range—on narrow latitude transparency film. On one occasion we managed to shoot with the flash recycle signal (a lightning bolt to the left of the focus OK LED) lit in the finder but got no flash. Loosening the retaining collar and seating the flash properly cured the problem. Finally, mounting the flash along with the 35–105 zoom caused the EOS to fall forward on its neckstrap, which was annoying and uncomfortable. This tendency may be slightly aggravated by the forward tilt of the flash, but it's certainly not a problem unique to this camera.

To say that we liked the Speedlight 420EZ

is an understatement. We consider it one of the best and most comprehensive flash units of its size in current production. And we hope that its low-voltage, rapid-fire flash capability and sophisticated ranging system are emulated by other flash makers.

No matter which criteria you apply—engineering sophistication, overall performance and quality, potential for future development, desirable features, handling, ergonomics or just plain practical usability as a picture-making machine—the Canon EOS 650 is a brilliantly successful camera. It also happens to be as superbly integrated and functional an "electro-optical-system" as you're likely to find anywhere. For all its whizz-bang features, it's a remarkably unimposing machine, fully capable of yielding fine results in the hands of most amateur photographers. And for all its "broad spectrum" appeal, it incorporates almost every feature a serious photographer might want, with the notable, but minor, exception of multiple-exposure capability.

In criticizing a camera of this caliber, one is reduced to picking nits—bemoaning the lack of a 50mm f/1.4 or anything between 16 and 28mm in the initial EF lens range, or carping about the fully automatic rewind that doesn't leave a tongue peeking out of the film cartridge. Perhaps that's as it should be when a proud and competent company like Canon takes aim at a first-class competitor like the Minolta Maxxum and concentrates the bulk of its formidable resources on producing a better machine. Yes, the EOS 650 is unquestionably a great autofocus SLR that's fully capable of seducing even the conservative anti-AF SLR crowd. But is it significantly better than any other AF SLR around? Now you've really got us over a lens barrel. (July 1987)

### PERFORMANCE

| Our Standard                                                                      | as Tested      |
|-----------------------------------------------------------------------------------|----------------|
| <b>Focal length:</b> ±5%<br>(47.50-52.50mm)                                       | 51.09mm        |
| <b>Aperture:</b> ±5%<br>(f/1.71-1.89)                                             | f/1.89         |
| <b>Distortion:</b><br>(± 1.5%)                                                    | 0.46% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.7 stops      |

### RESOLUTION

CANON 50mm f/1.8  
at 1:50

| f/  | Center (l/mm) | Corner (l/mm) |    |
|-----|---------------|---------------|----|
| 1.8 | Good          | 45 Excellent  | 40 |
| 2.8 | Good          | 50 Excellent  | 45 |
| 4.0 | Good          | 56 V. Good    | 50 |
| 5.6 | Good          | 56 V. Good    | 50 |
| 8.0 | V. Good       | 63 Excellent  | 56 |
| 11  | Excellent     | 63 Excellent  | 56 |
| 16  | V. Good       | 56 Excellent  | 50 |
| 22  | Accept        | 50 V. Good    | 45 |

### CONTRAST

CANON 50mm f/1.8  
at 30 lines/mm

| f/  | Center (%) | Corner (%) |    |
|-----|------------|------------|----|
| 1.8 | High       | 53 High    | 41 |
| 2.8 | High       | 53 High    | 42 |
| 4.0 | High       | 67 High    | 55 |
| 5.6 | High       | 64 High    | 56 |
| 8.0 | Medium     | 52 Medium  | 42 |
| 11  | High       | 51 High    | 40 |
| 16  | Medium     | 46 Medium  | 35 |
| 22  | Low        | 38 Low     | 29 |

## 50mm f/1.8 CANON EF

**Specifications:** 50mm f/1.8 Canon EF, No. 1015460 in Canon EF autofocus mount; accepts 52mm acc.; f/1.8–22 settable in half stops; min. foc. dist.: 18 in. (0.45m); \$130.

**Practical comments:** Autofocuses very quietly from infinity to min. dist. in 0.56 sec. (at EV 13 with high-contrast test target); in manual mode, focuses very smoothly over same range in just under 180° clockwise turn of 1/4 in.-wide textured focusing collar. No external aperture ring; legible green (footage) and white (metric) focusing numerals; limited (2 aperture) depth-of-field scale; ribbed barrel facilitates lens mounting and removal; very good dull black finish.

**Field test slides:** Overall, slides crisp and snappy. Wide open, corners slightly soft; improve noticeably at f/2.8 with corners equal to center by f/4. Flare well-controlled throughout. Overall, somewhat above average performance.

**Optical bench analysis** (for optical experts only): On axis, slight overcorrected spherical aberration with very slightly red-green flare, gone by f/5.6. Diffraction limit reached by f/16. Off axis, very slight skew-ray flare mixed with very slight coma, both almost gone by f/11. Lateral color present.

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## CANON EOS 620: AF SLR for Pros?

### MANUFACTURERS SPECIFICATIONS:

**Canon EOS 620 autofocus 35mm single-lens reflex camera.** Body No.1180485. **LENS:** 50mm f/1.8 EF Canon in Canon EF bayonet mount. **SHUTTER:** Electronic, vertical travel Canon metal blade focal plane with speeds from 30 to 1/4000 sec. plus B, X sync at 1/250 sec. **EXPOSURE SYSTEMS:** Segmented silicon photo cell above eyepiece reads evaluative or central limited-area metering pattern (with AE lock), for shutter priority, aperture priority, fixed and shiftable program autoexposure modes, plus metered manual exposure. Second SPD in bottom of mirror box provides centerweighted, off-the-film readings for TTL autofocus. EV range 1-20. **AUTOFOCUS:** Focus-priority (single shot) AF or continuous (servo) AF using TTL phase detection with Canon BASIS sensor in bottom of mirror box, audible focus OK signal, EV 1-18. **FLASH:** Five-pin dedicated hot shoe provides TTL flash off film surface with aperture and shutter speed predetermined by near-infrared pre-exposure flash when using 420/300EZ Canon flashes. **VIEWFINDER:** Fixed eye-level prism with user-changeable finder screens. Standard screen has central autofocus rectangle, indicating circle for limited-area metering and full-area manual focus. LED-lit LCD display shows shutter speed, aperture, metered manual exposure level. AE lock symbol, manual exposure indicator, flash ready, exposure compensation, autofocus indication, out-of-exposure and flash-range warning signals. **OTHER FEATURES:** LCD on top plate displays shooting mode, film wind mode, AF mode, shutter speed aperture, film speed, battery check, auto bracketing and multiple exposure readouts. Auto DX film speed setting ISO 25-5000, manual ISO 6-6400, auto load, auto wind, auto rewind, single and sequence film advance, electronic self-timer with LED, depth-of-field preview, mid-roll rewind, audible camera shake warning, provision for accessory data and command backs, interchangeable grips with or without remote terminal. **BATTERIES:** All power supplied by single 6-volt lithium battery. **PRICE:** \$819 with 50mm f/1.8.

In designing the EOS 620, an autofocus (AF) SLR aimed primarily at knowledgeable photographers and pros, Canon devised a disarmingly simple and effective strategy—integrate an array of useful (and tempting) advanced features into the basic EOS 650. However, constructing a pro caliber machine using the same chassis, electronics, in-lens micromotors and AF system as the broad-spectrum model can be risky. Fortunately, in testing, analyzing, and disassembling the EOS 650 (see *Modern Photography's* Modern Tests, July 1987, page 50) we found its overall performance to be at least as good as any of its similar AF

competitors, and we were equally impressed with its rugged, die-cast metal chassis, huge, sturdy, all-electronic lens mount and excellent ergonomics. Based on our hands-on experience and analysis of the EOS 650, we expect that its fraternal twin, the EOS 620, will stand up very well indeed to the rigors and the requirements of professional use.

In appearance, the EOS 620 and 650 are so nearly identical that it's tough to tell them apart without glancing at their nameplates. Both feature the same large, distinctively modern, polycarbonate-clad outer bodies, and both are somewhat lighter in weight than they look. Not surprisingly, the EOS 620 is beautifully balanced and extremely comfortable to hand hold—comments that apply equally to the 650. All controls on the 620 follow the same logical, straightforward pattern as those on the 650. In fact, the controls of both models are virtually identical. The sole exceptions: The 620 has an LCD-panel-illuminator button to the left of the partial (limited-area) metering button atop the thumb rest on the back, and some of its buttons provide, in combination, pro-oriented options not present or offered with the 650.

Since we've already covered the EOS 650 controls in punctilious detail in our July '87 *Modern Tests* report (available on request for \$1.50 including postage and handling from Modern's Reader Service Department), we needn't duplicate that elaborate description here. Herewith an abbreviated rundown for those who may not be familiar with the EOS system. To the left of the 620's eyepiece is the knurled main switch, which has four check-stopped positions; L for shutter-locked,

power off, green rectangle for basic program setting only. A or beep symbol for power on and mode selection available, with or without audible warnings.

Dial in one of the last two settings and you can change exposure modes by pressing the Mode button while turning the large, milled Input Dial behind the angled shutter release atop the removable handgrip. All settings (including exposure and AF mode, single or continuous film wind, frame number, aperture and shutter speed) are displayed on the large, clear LCD panel to the right of the pentaprism. Press the smooth electromagnetic release and these last two exposure settings are displayed for eight seconds on the LCD and in the finder below the screen in greenish LED-transilluminated digits. Finder readouts are more limited than those appearing on the LCD, but they also include a focus OK LED, manual exposure mode M, partial metering star and a 2 sign to warn if the exposure compensation has been set to a value other than zero.

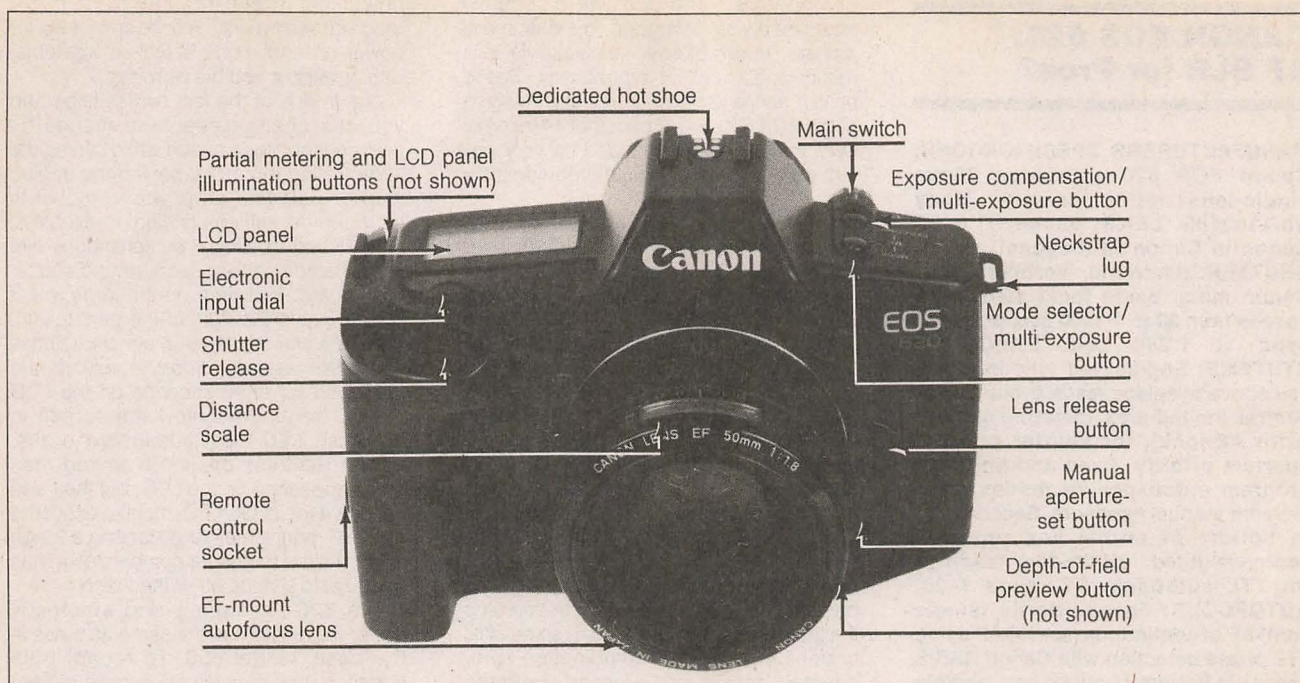
The 620's metering and autofocus systems are likewise the same as those in the basic model 650. To recap, both cameras provide evaluative, multi-pattern readings in all autoexposure modes by measuring light values for six separate zones off the focusing screen, analyzing them and then setting the exposure based on algorithms (patterns) stored in the camera's memory. This system is quite effective in automatically compensating for common exposure problems such as variable light and backlit subjects, and many variations in reflectivity or lighting that might ordinarily lead to underexposures or overexposures.

To cope with the small percentage of

### GENERAL PERFORMANCE

| Checkpoints                            | Our Standard                                                                                                       | As Tested                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>FINDER:</b>                         |                                                                                                                    |                                                    |
| Apparent viewing distance              | Between infinity and 20 in. (0.5m)                                                                                 | 39 in. (1.0m)                                      |
| Apparent distance of information scale | Between 79 in. (2.0m) and 26 in. (0.7m)                                                                            | 39 in. (1.0m)                                      |
| View area compared to film area        | Vertically and horizontally more than 90%, less than 100%                                                          | Vertical: 93%<br>Horizontal: 94%                   |
| Parallax error compared to film        | Vertical: 0.9mm<br>Horizontal: 1.0mm                                                                               | Vertical: 0.2mm (down)<br>Horizontal: 0.2mm (left) |
| Focusing accuracy at maximum aperture  | Within depth of focus                                                                                              | No Discrepancy                                     |
| Image magnification                    | 0.80X±.1x                                                                                                          | 0.83x                                              |
| <b>PICTURE SIZE:</b>                   | 24 ± 0.6mm x 36 ± 0.9mm                                                                                            | 24.3mm x 36.4mm                                    |
| <b>SHUTTER:</b>                        |                                                                                                                    |                                                    |
| Curtain travel evenness                | ±0.33 stop                                                                                                         | -0.1 stop                                          |
| Insulation from sync                   | More than 7 megohms                                                                                                | Infinity                                           |
| Sync contact efficiency                | More than 60%                                                                                                      | 84% (hot shoe)                                     |
| Sync delay time                        | X: within full opening                                                                                             | Okay                                               |
| Shutter curtain bounce                 | Not allowed                                                                                                        | None                                               |
| Self-timer delay                       | 7-15 seconds                                                                                                       | 10 seconds                                         |
| <b>CAMERA NOISE:</b>                   | 73 dB(a), average for autofocus SLR                                                                                |                                                    |
| <b>CAMERA SIZE:</b>                    | Body: 5¼ in. wide x 3¾ in. high x 2¼ in. deep (147 x 86 x 57 mm)<br>Lens: 1½ in. long, 2½ in. diameter (41 x 67mm) |                                                    |
| <b>WEIGHT:</b>                         | Body: 1 lb. 10½ oz. (752g) with batteries<br>Lens: 6½ oz. (185g)                                                   |                                                    |





situations (about three to four percent according to our tests) where the evaluative system can be fooled, and to provide EOS users with a convenient, comprehensive method of manual exposure control, Canon has wisely included another metering option—partial metering. Switch to metered manual mode, or hold in the partial metering button atop the thumb rest with the metering system turned on (in any AE mode but “green rectangle” program-only mode) and you’ll get partial (limited-area or semi-spot) metering, with the meter’s sensitivity concentrated in the central 6.5 percent of the picture area. To make things simpler, the partial metering button also locks in the reading as long as you hold it in, so you can achieve the benefits of metered manual control without switching out of any of the autoexposure (AE) modes—aperture- preferred (AV), shutter- preferred (TV) or Programmed autoexposure (P).

Manual metering with the 620 works exactly the same as with the 650. Switch to M mode and change shutter speeds by turning the Input dial. Once you’ve selected a shutter speed, press the M button at the bottom of the left-hand lens surround while turning the input dial to change apertures (in half stops) until you see the “oo” (correct exposure) symbol in the finder. Canon made an astute decision in having both EOSs switch to partial metering when you select manual mode—that’s precisely when you need to know exactly what your metering system is measuring.

So far there would seem to be precious little difference between the two EOS models, but open the magnetically locked switch cover below the hinged back and that impression will shortly change. Like the 650, the 620 has four buttons inside the switch compartment, all of which control less-often-used functions. From left to right, there’s a black mid-roll-rewind button, a yellowish AF mode button, a blue

wind mode/self-timer button and a black battery check button. Press the AF mode button while turning the Input dial and the panel on the lower left-hand part of the LCD changes from ONE SHOT (camera fires only if proper focus has been attained, locks shutter otherwise) to SERVO (camera continues to autofocus on moving subjects, shutter can be fired at any time). Do the same with the wind mode button, and the readout in the lower right-hand box of the LCD changes from S (single frame advance) to C (continuous advance at up to three frames per second) to self-timer (denoted by a clock face). Press the last two buttons at once and the ISO setting is displayed above the AF mode box for eight seconds, and you can change it by turning the input dial during that time. Press the fourth (black) button opposite a battery symbol and “bc” plus a series of dashes (three for full power) appears on the LCD.

So far, everything is just as it is on the 650, but the legend on the inner switch cover of the 620 has something not found on the 650—a line, marked AEB, connecting the AF mode and battery check button graphics. What is the mysterious AEB that you get when you press both these buttons? Automatic exposure bracketing, settable in increments from half a stop to five full stops!

Here’s how it works. Set any speed but B (bulb) and any mode but program only (green rectangle) and when you press both aforementioned buttons, AEB 0.0 appears in the middle of the LCD for eight seconds. Turn the input dial to change the 0.0 to any value between 0.5 and 5.0; and that’s the amount of variation (in exposure steps or EV values) you get between your bracketed exposures. For example, set the AEB to 1.0 and press the shutter release and the 620 will fire off a three-exposure sequence of “one stop under, correct metered exposure, and one stop over” in about a second (at normal hand-

held shutter speeds) and then clear itself for normal shooting.

If the camera’s set for one-shot AF mode the camera must attain focus before it fires an AEB sequence, but the original focus point is locked in regardless of the AF mode you’ve set. You needn’t set the wind mode to C (continuous wind) before firing an AEB sequence, and the system even works in M (manual exposure) mode and when using the partial metering AE lock button. However, it’s not usable for flash photography. Yes, you can shoot a bracketed sequence with exposure compensation dialed in, but the correct exposure point will be shifted based on the amount and direction of the compensation set. With the aid of Canon’s forthcoming Technical Back E, you’ll be able to autobracket up to nine exposures in one-quarter step increments.

In our field tests of the 620, we found that the autobracketing feature performed flawlessly and was especially useful in situations where a range of possible exposures could all produce different but equally dramatic or pleasing effects (e.g., with scenics or architectural views). However, when setting a wide bracketing value it is possible to get a non-hand-holdable shutter speed for the overexposed frame, a fact not mentioned in the instructions. Right now there is only one other SLR with built-in autobracketing (the Contax 167 MT), but in our view AEB would definitely make a worthwhile addition to any SLR used primarily by pros and advanced photographers.

Another telltale sign of one of the 620’s pro-oriented capabilities is found next to the mode and exposure compensation buttons to the left of the pentaprism. It’s a little ME with connecting lines in-between the words MODE and EXP. COMP. Hold in both these buttons and a boxed ME, and a 1 appears at the bottom of the LCD. You’re in multi-exposure mode. Hold the buttons in as you turn the input dial and you can set single digits up to 9, which, as you’ve



probably guessed, is the maximum number of multiple exposures you can get on a single frame. As you press the shutter release for each successive exposure the ME blinks and the shutter recocks, but the film winds to the next frame and the frame counter advances only after the set number of exposures has been completed. The clear, comprehensive instruction booklet provides ballpark exposure-compensation settings and good tips on shooting multiple exposures.

Although it doesn't sound quite as exciting as autobracketing, the Canon 620's program shift function is probably the most important feature that's not present on the 650. Select P mode (except by turning the main switch to green rectangle position), and you can shift the program by simply holding the shutter release partway in as you turn the input dial. Indeed, you can get just about any available aperture or shutter speed you wish, so long as the combination will provide the proper metered exposure. You can even shift the program quite comfortably while pressing the AE lock/partial metering button!

When you need to select a specific shutter speed or aperture while you're shooting in the program mode, this is certainly a rather simple and elegant way to get it. You needn't even take your eye away from the viewfinder since the settings in use are the ones displayed. Incidentally, the Canon 620, like the 650, *automatically* alters its exposure program according to the lens focal length being used to favor hand-holdable shutter speeds. As the light level increases, only the shutter speed gets faster until it reaches about one over the focal length of the lens mounted (or the zoom focal length set). From that point on, the diaphragm stops down and the shutter speed gets faster in equal amounts as the measured light level increases.

Push the lock button and slide the latch on the 620's left-hand side, swing open the removable back and you'll see that its interior looks identical to the 650's, which is to say beautifully finished with six gold-plated DX contacts in the film cartridge chamber and eight flat gold-plated contacts (for data and technical backs) to the right of the auto loading take-up drum. But there is something quite different right in the middle—the 620's shutter, a metal-blade vertical-travel unit that provides speeds of 30 seconds to 1/4000 second (settable in half-step increments) and X sync at up to 1/250 second. In comparison, the 650's metal-coated Mylar-blade shutter has a top speed of 1/2000 second and X syncs up to 1/125 second. Obviously, the faster top speed and especially the faster sync speed (which minimizes ghost images when shooting with flash in bright ambient light) are more in keeping with the requirements of advanced photographers.

Also present only on the 620 is the previously mentioned LCD panel illuminator button next to the AE lock/partial metering button. Press it and the large LCD panel is bathed in a jazzy blue electroluminescent glow and its readouts are clearly visible even in total darkness. The light turns itself off automatically after about eight seconds to

conserve battery power. Final 620-only tidbit: It comes with the GR-20 grip with built-in remote control socket, an option on the 650.

One clever feature that's missing on the EOS 620 but present on the 650 is the Depth Mode, which automatically calculates and sets the optimum aperture and distance needed to sharply render near and far subjects. Obviously Canon felt that deleting this feature from the EOS 620 would not impose undue hardship on advanced photographers who fully comprehend the relationship among shooting aperture, focusing distance and depth of field. We agree.

In field testing the EOS 620, we found that its autofocus performance was very good indeed, closely matching that of the 650 in terms of speed, precision, and the ability to focus in low light (down to EV 1) and with subjects of relatively low contrast. Although we are unable to quantify our observations (there is as yet no generally accepted method or standardized procedure for testing comparative autofocus performance) we are confident that the EOS 620 generally performs as well as the best of its competitors. We were particularly pleased with the sharp pictures we got when tracking fast-moving subjects (e.g., at a track and field meet and a motorcycle race) in servo AF mode.

Also deserving of praise are the extremely clear in-finder readouts, which manage to be unobtrusive yet always visible, and the clear, contrasty standard finder screen (there are presently seven others available), which is easy to focus with manually despite the absence of the usual focusing aids. Some staff members were less than enthusiastic about the nearly invisible circle defining the partial (limited-area) metering area (others felt a bolder one would be obtrusive) and all agreed that the autofocus brackets are too hard to see in dim light.

Overall handling of the EOS 620 is exemplary, aided by superbly ergonomic contours and thoughtfully placed controls. The EOS' manual focusing system is still the best on any AF SLR—full-sized, centrally placed focusing rings remain stationary in AF mode, and focus the lens only when you set the switch to M (manual focus) and turn them by hand. Manual focusing action is very smooth—perhaps a bit too smooth and underdamped. Even placing miniature focusing motors in each lens, as Canon has done with the EOS system, has not eliminated that nagging problem. It has, however, succeeded in creating the quietest autofocus system in any SLR.

Perhaps the most remarkable thing about the EOS is that it succeeds so well at being a professional-level camera. It is, after all, not so much a kissing cousin of the EOS 650 as its somewhat more talented twin brother. Essentially, Canon has taken the brilliant and unprecedented step of designing a single camera that meets the needs of everyone from tyros to pros, then splitting it into two slightly divergent models. Opt for the EOS 650 and you get the same rugged chassis, big sturdy lensmount, bright, contrasty viewfinder, sophisticated metering system and motor drive for less money. Go for the

620 and you get all that along with program shift, autobracketing, multi-exposure capability and a faster shutter plus all the user-friendly features found on so-called amateur cameras—auto loading, auto rewind, a program-only setting and a control system as simple and logical as that of any multimode SLR.

## 50mm f/1.8 CANON EF LENS

**Specifications:** 50mm f/1.8 Canon EF. No. 1015460 in Canon EF autofocus mount, accepts 52mm accessory; f/1.8–22 settable in half stop; minimum focal distance: 18 inches (0.45m); \$130.

**Practical comments:** Autofocuses very quietly from infinity to minimum distance in 0.56 seconds (at EV 13 with high-contrast test target); in manual mode, focuses very smoothly over same range in just under 180° clockwise turn of 1/4 inch-wide textured focusing collar. No external aperture ring; legible green (footage) and white (metric) focusing numerals; limited (two aperture) depth-of-field scale; ribbed barrel facilitates lens mounting and removal; very good dull black finish.

**Field test slides:** Overall, slides crisp and snappy. Wide open, corners slightly soft; improves noticeably at f/2.8 with corners equal to center by f/4. Flare well-controlled throughout. Overall, somewhat above average performance.

**Optical bench analysis** (for optical experts only): On axis, slight overcorrected spherical aberration with very slight red-green flare, gone by f/5.6. Diffraction limit reached by f/16. Off axis, very slight skew-ray flare mixed with very slight coma, both almost gone by f/11. Lateral color present.

### PERFORMANCE

| Our Standard                                                                      | As Tested      |
|-----------------------------------------------------------------------------------|----------------|
| <b>Focal length: ±5%</b><br>(47.50–52.50mm)                                       | 51.09mm        |
| <b>Aperture: ±5%</b><br>(f/1.71–1.89)                                             | f/1.89         |
| <b>Distortion:</b><br>(±1.5%)                                                     | 0.46% (barrel) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>(0–1.5 stops) | 0.7 stops      |

### RESOLUTION

**CANON 50mm f/1.8  
at 1:50**

| f/  | Center (l/mm) | Corner (l/mm) |           |
|-----|---------------|---------------|-----------|
| 1.8 | Good          | 45            | Excellent |
| 2.8 | Good          | 50            | Excellent |
| 4.0 | Good          | 56            | V. Good   |
| 5.6 | Good          | 56            | V. Good   |
| 8.0 | V. Good       | 63            | Excellent |
| 11  | Excellent     | 63            | Excellent |
| 16  | V. Good       | 56            | Excellent |
| 22  | Accept        | 50            | V. Good   |

### CONTRAST

**at 30 lines/mm**

| f/  | Center (%) | Corner (%) |        |
|-----|------------|------------|--------|
| 1.8 | High       | 53         | High   |
| 2.8 | High       | 53         | High   |
| 4.0 | High       | 67         | High   |
| 5.6 | High       | 64         | High   |
| 8.0 | Medium     | 52         | Medium |
| 11  | High       | 51         | High   |
| 16  | Medium     | 46         | Medium |
| 22  | Low        | 38         | Low    |



## CANON'S NEW F-1: A VERSATILE "PRO"

### MANUFACTURER'S SPECIFICATIONS:

Canon New F-1 35mm single-lens reflex camera. Body No. 100794, LENS: 50mm f/1.4 Canon FD in interchangeable bayonet breech-lock mount, stops to f/22, focusing to 18 in. (0.45 m), accepts 52 mm screw-in or Canon bayonet accessories. SHUTTER: Electro-mechanical hybrid titanium focal-plane with electronically-controlled speeds from 8-1/2000 sec., mechanically-controlled speeds of X sync (1/90 sec.) to 1/2000 sec. plus B operable without battery power, electronic self-timer. VIEWING: Interchangeable eye-level prism with interchangeable focusing screens; standard screen has central split-image rangefinder with surrounding microprism collar, full-focusing outer area. Aperture scale at right of finder with standard prism shows camera-suggested aperture via needle, set aperture via pointer, over/underexposure warning markings set shutter speed below; in shutter-preferred mode with winder or motor and power source mounted, camera-selected aperture and set shutter speed are visible. OTHER FEATURES: Single SPD cell behind viewing screen, powered by 6-v lithium, alkaline-manganese or silver oxide cell in body, reads center-weighted averaging, limited 12% area or 3% central spot area of finder field depending on screen unit fitted; with AE Finder FN, aperture-preferred auto or match-needle readings possible; meter is shutter-release activated in normal mode remains on for 16 sec. in "hold" mode, on and aperture/shutter readouts lit in "light" mode; ASA settings 6-6400,  $\pm 2$ -stop exposure-compensation control; metering at working aperture via stop-down/depth-of-field preview control; battery-check button also cancels scale illumination, meter readings, self-timer; built-in eyepiece blind; dedicated contacts in hot shoe provide auto flash-sync speed, auto aperture range readout and/or setting, recycling indication in finder with Canon New CATS system flash units; electromagnetic shutter release operates mechanically without battery power, multiple-exposure provision; shutter button lock; accepts accessory bulk film back and data back. PRICE: \$980 with 50mm f/1.4 Canon FD lens; and standard FN finder; \$912 with 50mm f/1.8 Canon FD lens and FN finder; AE Finder, \$222.

To say that Canon's new flagship professional SLR had the camera cognoscenti in a dither when it was officially introduced in July, 1981 is something of an understatement. Aside from the unprecedented nomenclature coup of continuing the traditional F-1 model name (without so much as a subscript letter or logo change) for a radically new camera, there was the little matter of the New F-1's metering system and finder readouts. Was it possible that the world's most successful producer of auto-exposure SLRs—the wizards who mated electronic calculator concepts and multi-mode exposure automation to give us the still-unrivaled Canon A-1—had answered the likes of the Nikon F3 and the Pentax LX with something as pedestrian

as a match-needle-metering camera with conventional moving needle and lollipop-shaped aperture pointer? Well, sort of. If you purchase a Canon New F-1 with the official standard (in the U.S.) Eye-Level Finder FN, that's exactly what you'll get. But lurking within and without, above and below this remarkable machine, is what might be termed a hyper-modular approach which lets you create just as much or just as little camera as you need for any specific assignment.

We use the word "assignment" purposely, too, for if any SLR we've ever handled gives the impression of being a camera designed by pros for pros, this is it. And it's important to remember that professional photographers are an ultra-conservative lot when it comes to selecting equipment. They say all they want is manual exposure control, mechanical shutters, super reliability under hard use and adverse conditions, and no extra gadgets or fripperies. Canon has obviously listened to these influential customers, but the genius of the New F-1's designers and engineers is in giving professional photographers more than they ever asked for without alienating them. In so doing, they've created a superbly competent and flexible camera that's destined to serve a much wider spectrum of photographers.

Like the legendary Nikon F of 1959, the heart of the Canon New F-1 is located in its head—that is, in and around the prism area. But in the Canon tradition, the main metering system and control circuitry are in the body, not in the interchangeable pentaprisms. Remove the standard Finder FN, replace it with the slightly taller AE Finder FN, turn the shutter dial to "A" and you've got aperture-preferred auto exposure with full finder readouts below the focusing screen. Mount either the AE Motor Drive FN or the AE Power Winder FN and any of its three power sources to the bottom of the F-1, set the lens aperture dial to the green "A" setting (past f/22 on 50mm lenses), choose your shutter speed and the bottom readout scale disappears; it is replaced by a vertical aperture scale with a needle reading out camera-selected f/stops along the right-hand side of the finder. User-selected shutter speeds appear in a little window directly below the aperture scale.

Just below the slide-out pentaprism, you'll find something even more ingenious—user-interchangeable focusing screens that provide a choice of center-weighted averaging, limited-area (12%) metering or spot metering (3% in the center of the viewing area). Only six of the more popular screen configurations are available in all three metering patterns, but the remaining seven screen types can be purchased in either center-weighted or selective-area patterns. We'll describe how Canon's clever refinement of off-the-screen metering works a bit later on, but we will note here that all the above-mentioned screens incorporate Canon's new Laser Matte outer focusing area which gives an extraordinarily bright view, and those screens having central split-image rangefinders employ Canon's stepped "New Split" crossed prisms which obviate partial rangefinder blackout even with lenses as slow as f/5.6.

Before we get into the F-1's operations, let's say a few words about the camera's basic body construction. Like Nikon and Pentax which preceded them, Canon has clearly gone to great lengths to make their top-of-the-line pro SLR hell for strong. The F-1's

main body casting, which comprises virtually the entire body shell, is a model of structural rigidity and, while it's fabricated of alloy for lightness, durability and strength are clearly its primary design objectives.

The only major secondary casting is the squarish alloy casting containing the lens mount, which affixes rigidly to the main body casting with four hefty counter-sunk screws. The chromed brass lens mount is similarly mounted onto this front casting. This system actually increases the strength of the whole body structure and ensures accurate lens-to-film-plane alignment even if the camera is subjected to physical abuse.

Canon is obviously proud of the fact that the F-1's main body (and the AE Finder FN) are machined on the latest numerically-computer-controlled (NC) milling machine, which reduces the number of machining operations required while increasing accuracy in drilling to  $\pm 0.02$ mm. Other exotic manufacturing techniques include laser-beam welding (instead of rivets) to connect the gear to the pinion shaft of both front and rear shutter curtains, shot-burnishing of these shafts to increase their strength, and sealing and encasing the printed circuit board in a moisture-proof resin. Plastic and rubber seals are found in numerous places within the camera body, including the shutter-release button and shutter-speed dial, and both shutter-curtain release magnets are silver plated "for greater dust- and moisture-proofness."

All right, now that we have a general notion of the new F-1's identity and capabilities, let's see how it functions. But first a few passing words on the standard Eye-Level Finder FN, which comes with the FN-PE focusing screen. The "P" in PE stands for "partial" (that is, selective-area) metering, with sensitivity concentrated in the central 12% of the viewing area. The "E" denotes a screen having a central, horizontal, split-image rangefinder surrounded by a microprism collar and full-focusing outer area. In bright light, or when viewing light-colored subjects, the metering area is visible as a clearly-defined grayish rectangle in the middle of the screen surrounding the central focusing aids—a sight that should be familiar to "old Canon F-1" owners and users of other previous Canon SLRs with behind-mirror metering systems. However, the metering-area pattern is less pronounced in the New F-1.

Merely hefting the New F-1 with a normal lens mounted gives you a feeling of its overwhelming solidity. This is probably due to a combination of factors—including its medium size, moderate-to-heavyish weight, excellent balance, and ergonomically-rounded contours, including an Action Grip/battery compartment cover on the front that feels even more comfortable than the grips on previous Canons, notably the A-1. Also, to repeat a well-known automotive cliché, all the controls—especially the film-wind lever, shutter-speed dial, and the shutter-release and its surrounding mode-selector collar—fall readily to hand.

Let's examine this conveniently-placed control cluster in more detail. The film-wind lever is comfortably contoured to the thumb, all plastic, and has a 30° stand-off angle. It's ratcheted to advance in a single 139° stroke or a series of shorter strokes; we're pleased to report that its action is very good indeed. No, it's not as buttery smooth as the wind lever on an M-series Leica, but it's a significant improvement over previous Canon

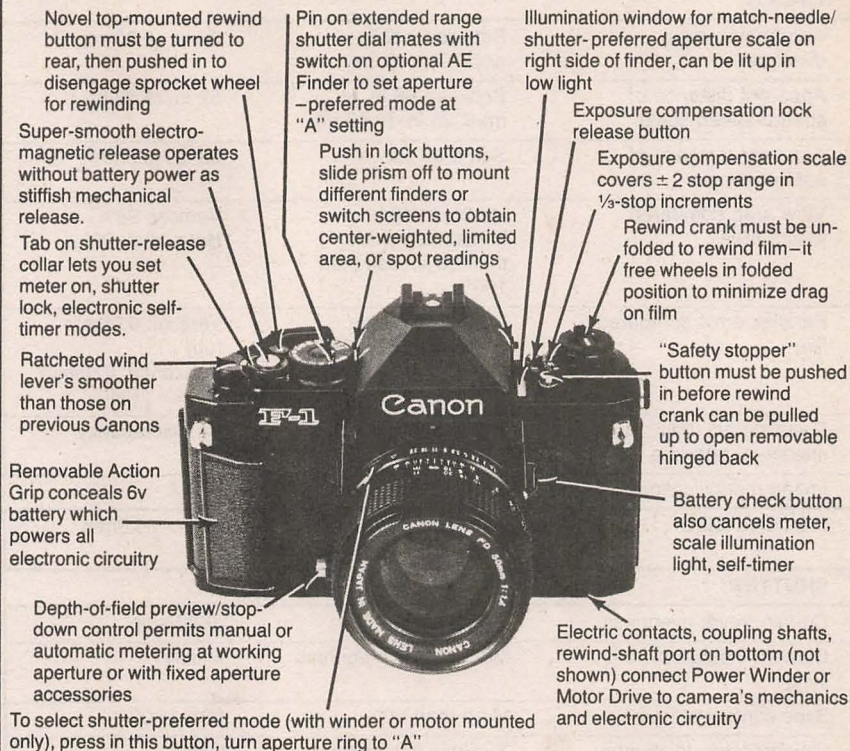


SLRs, and the equal of any found on a current SLR. The shutter-release button is also outstanding—light, smooth, and predictable in action, and surrounded by a handily placed mode-selector collar. Grab the knurled-edge tab of the collar and set the white letter "A" opposite the index line adjacent to the rewind control and the meter system is activated. Turn the collar to the red "L" and the shutter button is locked. Select the white "S" setting and press the shutter release and the built-in electronic self-timer counts off 10 sec. with one beep per sec., for the first 8 sec., 2 beeps per sec. for the last 2 sec. until the shutter is released. The shutter-speed dial is conventional except for its extended range from 1/2000 sec. to 8 sec. plus the flash sync (at 1/90 sec.) setting denoted with a blitz mark, B, and the red "A" setting used with the AE finder. Settings from 1-1/2000 sec. are very legibly engraved in white-on-black as are the flash sync and B settings, while timed shutter speeds slower than 1 sec. are in yellow and the "A" setting is in red. To set the shutter dial to "A" (aperture-preferred auto exposure with the AE finder) you have to lift up and turn it simultaneously, thereby minimizing setting errors. But if you do accidentally set the dial to "A" with standard FN finder in place the shutter-speed scale appears below the finder field and the shutter won't fire until you select a manual shutter speed—a most thoughtful safety feature.

Rounding out the features on the top deck, atop the standard FN prism (and the AE prism as well) is an integral hot shoe with dedicated contacts for Canon electronic flashes using the New CATS system we'll get to later on. To the left of the prism housing is a large 1 1/8-in.-diameter knurled dial surrounding the rewind crank. Push inward on a small silver tap on the dial's edge as you turn its outer milled surface and you can set ASA/ISO film speeds from 6-6400 in a small window with an index mark near its center. Despite the extended range, the numerals are legible in green on black. On the right side of the dial is the exposure-compensation scale covering a  $\pm 2$  stop range in 1/3-stop increments. It's easy to see—and we like the fact that it's calibrated in the sequence 1/4, 1/2, 1 (in green) 2, and 4 to eliminate confusion—but there's no warning signal in the finder or elsewhere to remind you to set it back to "1" after using it. At any rate, it's conveniently set by pressing in a small black button below the aperture scale illumination panel as you turn it to the desired setting.

This brings us to the rewind crank, which works in conjunction with the novel rewind button just behind the shutter button and has a few additional small-but-interesting features. First, to open the hinged camera back you must press in the silver colored safety lock button (Canon calls it a Safety Stopper) located at about 2 o'clock with respect to the ASA/compensation dial, as you pull up sharply on the rewind crank. To rewind the film you rotate the notched part of the swiveling top of the rewind "button" toward the back of the camera, then push it in until it clicks. Now you can unfold the rewind crank and rewind the film. The crank itself is very easy to turn, without the nasty habit of folding in mid-wind like some other cranks that have been engineered to clear top-mounted accessories, and it's comfortable as well. However, don't make the mistake of trying to turn it without unfolding the crank first or you won't accomplish a thing. Presumably, the fact that

## What's New At A Glance: Canon New F-1



the rewind crank is free-wheeling when folded reduces the friction on the film wind by some minuscule quantity. The fact that the New F-1 is capable of 5 fps on the high-speed setting with the motor drive probably has something to do with this.

Although the front of the Canon New F-1 is sufficiently unadorned to appear spartan, some important features lurk within its smooth contours. First, there's the battery compartment behind the removable Action Grip. Press in a small black button concealed under the bulge of the grip and lift it off, revealing the compartment containing a 6-v lithium, alkaline-manganese, or silver-oxide battery (our F-1 came with a Japanese-made lithium battery, the type recommended for cold weather use). The bottom or negative terminal at the bottom of the chamber is spring loaded for added security (the camera will work normally even if you lose the grip/cover), but there's an ulterior motive afoot here. Suppose you press the battery check button (it's atop the left-hand front of the prism housing behind the mounted lens) and the needle in the finder fails to move above the battery check mark on the aperture scale or fails to move at all? That means you have a weak or dead battery, respectively. Indeed, if the battery is too weak to provide accurate exposure readings, the shutter won't fire. But, you protest, in the specifications listed at the beginning of this very report it states that the Canon New F-1 has an electro-mechanical hybrid shutter providing mechanically-timed speeds of 1/90 sec. (flash sync), 1/125-1/2000 sec. plus B without any battery power. That's true, and to get to them you must first remove the dead battery, thus releasing the spring-loaded negative contact

in the battery compartment which activates the mechanical shutter-timing mechanism. If there's any more effective means of letting the photographer know he's out of "juice" we haven't heard of it. However, despite the ingenuity of Canon's engineers and the accolades of professional photographers for providing a commendably complete range of no-battery shutter speeds, there is a small fly in the molybdenum disulfide lube. No, it's not the mechanically-timed shutter speeds themselves, which are quite accurate; it's the shutter-release button. Remove the battery and the release is no longer electromagnetic but mechanical, and unfortunately its performance deteriorates from superb to merely acceptable, with a coarse, stiffish action requiring relatively high finger pressure.

Returning to the battery-check button, it does several things besides check on battery power and is, in effect, a main circuit turn-off switch. It can be used to cancel the self-timer in mid-beep, turn off the meter and meter scale illumination in the "Hold" or "Light" modes we'll detail shortly, or to terminate long auto exposures made in very dim light. On the right-hand side of the mirror box, near its bottom, is the time-honored Canon aperture-stop-down control which permits manual or aperture-preferred auto exposures at working aperture. Press it in and release it, exposing a red warning band on the plunger, and Canon FD lenses will stop down to the aperture set on the f/stop ring, the lollipop-shaped aperture pointer appearing on the aperture scale in match-needle mode will disappear; non-coupling, manual or fixed-diaphragm optics can be metered manually (with respect to a fixed index line opposite the f/5.6 setting on the aperture scale at the right



## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                                                                                                                                                                           | As Tested                                          |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                                                                                                                                                                        |                                                    |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                                                                                                                                     | 36 in. (0.90 m)                                    |
| Apparent distance of shutter-speed scale | Between 66 in. (1.7 m) & 25 in. (0.62 m)                                                                                                                                                                                                                               | 52 in. (1.33 m)                                    |
| Apparent distance of aperture scale      | Same as above                                                                                                                                                                                                                                                          | 33 in. (0.83 m)                                    |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                                                                                                                                                              | Vertical: 96%<br>Horizontal: 98%                   |
| Parallax error compared to film          | Vertical: 0.48mm<br>Horizontal: 0.36mm                                                                                                                                                                                                                                 | Vertical: 0.08mm (up)<br>Horizontal: 0.05mm (left) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                                                                                                                                  | No discrepancy                                     |
| Image magnification                      | 0.8X ± .1X                                                                                                                                                                                                                                                             | 0.81X                                              |
| <b>PICTURE SIZE:</b>                     | 24 ± 0.6mm x 36 ± 0.9mm                                                                                                                                                                                                                                                | 24.2 x 36.3mm                                      |
| <b>SHUTTER:</b>                          |                                                                                                                                                                                                                                                                        |                                                    |
| Curtain travel evenness                  | ±0.33 stop                                                                                                                                                                                                                                                             | -0.20 stop                                         |
| Camera insulation from sync              | More than 7 megohms                                                                                                                                                                                                                                                    | Infinity                                           |
| Sync contact efficiency                  | More than 60%                                                                                                                                                                                                                                                          | 92% (PC)                                           |
| Synchronizer delay time                  | X: within full opening                                                                                                                                                                                                                                                 | Okay                                               |
| Shutter curtain bounce                   | Not allowed                                                                                                                                                                                                                                                            | None                                               |
| Self-timer delay time                    | 7-15 sec.                                                                                                                                                                                                                                                              | 10 sec.                                            |
| <b>LENS:</b>                             |                                                                                                                                                                                                                                                                        |                                                    |
| Focal length                             | 50mm ± 5%                                                                                                                                                                                                                                                              | 49.64mm                                            |
| Maximum aperture                         | f/1.4 ± 5%                                                                                                                                                                                                                                                             | f/1.40                                             |
| Distortion                               |                                                                                                                                                                                                                                                                        | less than 1% (barrel)                              |
| <b>CAMERA SIZE:</b>                      | Body (with standard prism): 5 <sup>7</sup> / <sub>8</sub> in. wide; 3 <sup>7</sup> / <sub>8</sub> in. high; 1 <sup>7</sup> / <sub>8</sub> in. deep (149 x 98 x 48 mm) Lens: 1 <sup>3</sup> / <sub>4</sub> in. long; 2 <sup>1</sup> / <sub>2</sub> in. dia. (44 x 63mm) |                                                    |
| <b>WEIGHT:</b>                           | Body: 1 lb. 12 <sup>1</sup> / <sub>4</sub> oz. (800g)<br>Lens: 8 <sup>1</sup> / <sub>16</sub> oz. (232g)                                                                                                                                                               |                                                    |

of the finder) or automatically (with the AE prism fitted and the shutter-speed dial set to "A"). Like the battery-check button, the stop-down control does more than meets the eye, but it must be used with caution. Press it while the exposure is being made, or try to mount a lens with a plunger in the "out" position, and you can jam the camera.

Turning to the back of the New F-1 we find two small-but-significant controls near the top. To the left of the rubber eyepiece bezel on both the plain and AE prism finders is an eyepiece-shutter lever. Move it toward the right, uncovering a red warning dot, and a blind comes into position to prevent stray light from entering the eyepiece when the photographer's eye isn't up to the finder, thus causing inflated readings. This is an extremely important feature on any SLR which meters off the screen, particularly a pro SLR which may often be used with remote-firing accessories. Just below the rewind knob is a second small-but-vital control, a knurled-edge dial with a white index line that can be set to "Normal," "Hold" or "Light." The "Normal" setting is, as you would suspect, the

most commonly used, and it's the most energy-efficient in terms of battery consumption. On "Normal," the camera's metering and readout systems are activated only when the shutter collar control is set to "A" or "S," and the shutter-release button is pressed partway in. In the AE modes, the needle points to either the camera-selected shutter speed or aperture, and in match-needle mode with the plain FN finder, the needle points to the camera-suggested aperture as long as you maintain pressure on the release. Relax your finger and the meter turns off instantly. Set the control knob to "Hold," press the shutter button once and the meter stays on continuously for 16 sec. and then turns itself off. Select the "Light" position and press the shutter button and the meter stays on for 16 sec. as above and the aperture scale and set shutter speed in the window below it lights up—a boon to "available darkness" photographers or those shooting with flash in dim light. And how do you light up the shutter-speed and set-aperture scales appearing below the finder image when the AE finder is used in aperture-pre-

ferred mode? You don't—the light is built into the body, but not into the AE finder and it therefore works only in conjunction with match-needle and shutter-preferred meter modes. Is there anything else significant on the F-1's backside? Just the standard film-box-end clip on the removable back.

Now that we've covered the F-1's basic controls (with the exception of the bottom-mounted components which we'll get to in discussing the motors and winders) let us load up and take some pictures using the three basic exposure modes and the three separate metering patterns. To load the New F-1, open the back as previously described and load the leader into the multi-slotted take-up spool. Aside from minor touches such as extra long film-plane and film-guide rails, twin film-guide rollers which come into position over the sprocket wheel as the back is closed, and a standard Canon cartridge orientation spring on the opposite side of the oversized, beveled pressure plate, it's all very straightforward. Not surprisingly, the overall finish of the interior is a notch or two above that found in "mass market" Canons such as the AE-1. Oh yes, below the right side of the bottom film-guide rail is an electric contact for the Data Back FN. The data information panel therein is thereby illuminated as the shutter fires.

Presuming we've now wound on three blank exposures, bringing the smallish-but-legible additive exposure counter in front of the wind-lever from "S" to "1," and have set the ASA dial appropriately, let's take some photos using the standard, match-needle-metering FN finder and its PE selective-area metering screen. Set the shutter release collar to "A" and the meter-mode selector to "Normal," bring the camera to eye level and press the shutter release partway in. Instantly, the meter needle in the vertical aperture scale to the right of the finder field rises to the aperture that will give a correct exposure with the numerical shutter speed we've selected and the film speed set. By maintaining slight pressure on the release the meter remains on and the needle stays put. Now with the left hand, grab the knurled aperture ring near the back of the 50mm f/1.4 Canon FD lens and turn it until the lollipop-shaped, set-aperture-indicating follow-pointer moves over the needle so the needle bisects its circular end. Aside from the fact that the F-1's needle pops up to suggested aperture position very swiftly, this is the time-honored match-needle system that's been in use for over 20 years. Refinements? Yes, minor ones. The red "underexposure" or "below meter range" band near the bottom of the vertical aperture scale moves, as the lens is mounted, to indicate the maximum aperture of the lens in use, and the aperture needle moves only between the minimum and maximum apertures of the lens fitted. The upper red "overexposure" area covers the range from above f/16 to above f/32 and has notches in between f/16 and f/22, and f/22 and f/32. But it's stationary, so you have to remember the minimum aperture of the lens in use to know whether to select a faster shutter speed. Canon thoughtfully points out in their instruction booklet that the diameter of the aperture-pointer circle represents one full stop and the width of the stop-down-metering index line is one-half stop, so you may adjust the exposure to your taste while metering, without using the exposure-compensation control. The meter will not read if the shutter dial is set to the flash sync



setting or to B, and the shutter will not fire with the lens aperture set to "A" unless the motor or winder is mounted—intelligent and worthwhile safety features that will be appreciated by hard-pressed working pros.

All right, now let's mount the AE finder. To do so, first grab hold of the standard FN finder by its two back corners so that your thumb and forefinger press in the two finder lock buttons, and slide it back and off the camera. As you do so, notice the beautifully-finished, very precise tongue-in-groove mounting system, the little "prism window" on the left side of the prism unit (which reflects the aperture scale from a tiny oblong window under the camera's left-hand prism-mounting groove into the finder), and the four electric contacts under the front of the prism (which transfer information between mounted Canon flash units via the dedicated hot shoe atop the prism). Now slide the AE Finder FN in place until it clicks and you're ready to go.

Physically, the AE finder is quite similar to the ordinary FN finder except that it's  $\frac{5}{16}$  in. taller, incorporates a light-collecting panel for the aperture-preferred readout scale near the top of its front panel, and has an arm containing an ingenious switch emerging from its right-hand side. Here's how it works.

If you haven't mounted a motor or winder, and neither the lens aperture nor the shutter-speed dial is set to "A," the AE finder operates precisely like the ordinary FN finder, with the same match-needle scale appearing to the right of the finder field. The only difference is that F-1s purchased with the AE finder are fitted with Focusing Screen FN-AE, providing the same array of central focusing aids but having a center-weighted averaging sensitivity pattern. Canon deems this the appropriate sensitivity pattern for auto-exposure photography.

To get aperture-preferred automation with the AE finder, all you do is turn the shutter-speed dial to "2000," then lift and turn it to the red "A" setting just past it. As you do this a pin located in between the flash sync mark and the 8-sec. setting on the shutter dial contacts a spring-loaded switch under the aforementioned "arm" on the right side of the prism housing. This simultaneously sets the camera's circuitry for aperture-preferred automation and changes the finder readouts dramatically. An opaque cover slides in place over the right-hand aperture scale, causing it to disappear from view and a wide, horizontal shutter-speed scale with readout needle and a separate set-aperture window at its right come into view *below* the finder field. Aside from being a dramatic way to let you know you're in aperture-preferred mode, Canon's system effectively eliminates "finder readout clutter," keeping the visible digits to the bare minimum required.

To get the set aperture in the little window to the right of the shutter-speed scale, Canon has employed the standard method of reflecting it off the lens aperture ring via a tiny angled prism in the AE finder's overhanging front section, just below the Canon nameplate. As for the shutter-speed scale, its large, black-on-white digits and readout needle are clearly visible in all but the dimmest light, it's bounded on either side by red under- and overexposure warning areas, and it covers the range from 8-1/1000 sec. That's right—1/1000 sec. is the top shutter-speed limit in aperture-preferred mode, whereas 1/2000 sec. is available in both match-needle and shutter-preferred modes. Finally, Canon

warns that camera-selected shutter speeds in aperture-preferred mode are determined the moment the shutter is pressed, so if the light changes in the instant between release and execution, or while the shutter fires, this won't be taken into consideration and poor exposures may result. In shutter-preferred mode the reverse is true—the camera-selected aperture can be modified up to the very moment of exposure.

At any rate, in our opinion, the AE finder adds so little to the F-1's bulk or weight (it weighs but 1 1/4 oz. more than the standard finder), and extends the camera's versatility so substantially that it's hard for us to envision even the most hidebound pro or the most conservative advanced amateur ordering the camera with the standard finder alone. Since both prism finders can be used in the shutter-preferred mode with a motor or winder attached to the camera, one gains much and loses virtually nothing in opting for the more versatile AE finder.

As long as we've brought the subject up, let's mount the AE motor Drive FN and see how the camera works in conjunction with it to provide shutter-preferred automation. Either the motor or the AE Power Winder FN and a functioning power pack must be attached to the F-1 before it will work in the shutter-preferred mode—yet another thoughtful safety feature—but we'll concentrate on the remarkably compact motor drive because it's more interesting and comprehensive, and more in keeping with the Canon F-1's professional status.

To begin this little adventure, turn the camera upside-down and examine its bottom plate with the lens pointing downwards. You'd better have a dime or a penny in your hand because you've got to remove three round cover plates before you can affix the motor. On the left-hand end, next to the six winder and motor-drive terminals is the rewind coupler cover (which needn't be removed when mounting the winder). Unscrew it and you'll see a hole through which the motor's power rewind shaft passes to engage the extended end of the film-cartridge spool. So the small price you pay for having power rewind is not being able to remove the motor with film in the camera—just like the Nikon F3. About an inch to the right of the aforementioned cover is another smaller cover which must be removed before mounting either the winder or the motor. This is the AE coupler cover; it frees the camera's internal mechanisms to operate in shutter-preferred mode. On the right-hand end of the bottom plate is the last cover you must remove to obtain powered film advance. Naturally enough, it's called the winding coupler cover. Finally, about half an inch to the left of the winding coupler cover, there's an auxiliary rewind button that mates with a rewind shaft that emerges from the motor unit as you slide the motor's rewind switch on. This eliminates the need for pressing the rewind button before power rewinding.

Now that we've unscrewed our little trio of protective covers, where do we store them? Easy, just nest them together inside each other and screw them into the threaded compartment on the bottom of the motor unit. Now, before mounting the motor, let's check the condition of the 6-v battery in the camera body. Why? Because the battery can't be removed once the motor is mounted—the vertical grip/release gets in the way. Finally, before screwing the motor unit into the cam-

era's tripod socket, Canon advises you to check that the tabs on the motor's film-wind coupler engage the notches in the camera's winding coupler. Now, with your thumb on the motor's mounting screw, orient the motor drive unit, making sure that the locating pin adjacent to the film-wind coupler slides into the proper hole in the camera bottom, and screw the motor securely in place.

Before the motor will work, we obviously need a power source. Canon gives you a choice of three: the Battery Pack FN, usable with 12 AA cells of any type but nicads, the rechargeable Ni-Cd Pack FN (an extremely lightweight unit with non-removable nicad cell which we used for the bulk of our tests), and the larger, heavier High Power Ni-Cd Power Pack FN. In terms of framing speed, Canon claims that the AA Battery Pack and the High Power Ni-Cd Pack provide 3.5 fps on "low" speed setting and 5 fps on "high" speed setting, respectively, whereas the regular Ni-Cd Pack provides 3 fps and 4.5 fps at these settings. In addition, the larger packs will reportedly advance up to 50 rolls at normal temperatures, while the smaller Ni-Cd Pack will run 30 rolls of film through the camera. The High Power Ni-Cd Pack is the obvious choice for cold weather photographers as it will advance approximately 20 rolls of film even at -4° F, while the other two power sources will only advance five rolls. All three power packs have covered remote-control outlets at the back, locking auxiliary shutter buttons in cavities in their right sides for more convenient vertical shooting, and a set of five electric contacts on a raised circular platform which mate with similar contacts at the bottom of the motor's right-handed grip. To mount any of the power packs, orient the stud on the pack's left-hand end with a matching receptacle on the bottom of the motor, flip the locking tab on the left-hand side of the motor to "lock" position, and with your much-used coin of the realm, secure the pack to the motor with a locking screw on its right-hand end. Presuming you've got fresh batteries in your pack or your nicad unit is charged, you're now ready to begin shooting.

Before we attempt shutter-preferred metering, let's examine the motor's controls in more detail. Atop the comfortably contoured grip is a conveniently-angled, larger shutter button with surrounding knurled selector collar. Lift and turn the collar and you can set white-on-black letters S (single frame), L (low speed), H (high speed) and OFF (in orange) opposite a fixed white index line. Since we've just detailed the comparative framing rates, the meaning of these should be obvious. On the back of the motor unit are additional controls which are likewise logically arrayed. To the right of center there's the standard subtractive frame counter that turns the motor off once the counter reaches zero, and there's a reset button to its right which sets the counter back to "S," and a knurled metal wheel marked "SET" for setting the counter to the number of frames on the roll or the number you'd like to shoot in a given sequence. Numbers 36, 24, 20, and 12 as well as numbers 6 through 0 appear in orange rather than white-on-black. Just below the "SET" control is a red warning lamp which lights when you reach the end of the roll or when you've finished rewinding (to remind you to turn off the power rewind switch). Near the left-hand end of the motor is the sliding rewind switch. You must push in a little lock button to its left as you slide the switch—yet another small but



## 35MM Single Lens Reflex

thoughtful safety feature. With fresh batteries, a 36-exposure roll is completely rewound in about 10 sec. If that's too fast to avoid static marks in cold or dry weather, you can always rewind manually as previously described with the motor in place. Oh yes, that little cover above the rewind lock button on the motor is labeled F.C. to indicate that behind it is a set of six contacts that mate with the Film Chamber FN-100, the F-1's 100-exposure magazine.

In use, the F-1/AE Finder/Motor Drive/Ni-Cd Pack combination works splendidly. Indeed, in terms of overall capabilities, balance, convenience and handling it rivals the Nikon F3 motor drive combo we praised so highly, and provides the additional benefit of shutter-preferred automation, a feature lacking on both the Pentax LX and the Nikon F3. To select shutter-preferred mode you simply press the button located just past the green "A" setting on the aperture ring of current Canon FD lenses and move the aperture ring so the "A" setting appears opposite the orange index line atop the lens barrel. You also have to select a timed shutter speed other than the flash sync setting or "A." If you leave the shutter dial set to "A" you'll get aperture-preferred automation at f/22—which usually gives you non-hand-holdable shutter speeds.

Once you select a reasonable shutter speed and then turn the aperture ring to "A" with the motor or winder attached, the lollipop-shaped aperture pointer disappears and the moving needle reads out the camera-selected aperture as long as you keep the shutter button partially depressed or select "Hold" or "Light" modes on the mode selector. This analog readout system is so clear, decisive, and informative at a glance that Canon's reasons for choosing this "dated" method are evident. Also, most pros prefer it. But aren't digital electronics more rugged? Perhaps, but in the "auto" modes, the finder readouts are only indicators—the actual exposure is set electronically.

Some experts (including some members of our staff) criticized Canon for not providing both aperture- and shutter-preferred modes in the body without the need for adding extra accessories. When you consider that the Canon A-1 has these modes and more built in, their complaints seem to make sense. However, the F-1's concept of providing discrete finder readouts for each auto-exposure mode works very well in practice, and the FN motor and winder are so well engineered and unobtrusive in use that few pros will object to the extra size and weight needed to get shutter-preferred automation. Final pros and cons: The motor's (and winder's) shutter buttons are exemplary in action and "feel," but advancing film manually with the wind lever and the power turned off feels rough and requires excessive effort.

This brings us to the screens, which comprise an integral part of Canon's unique metering concept. We've already mentioned each metering pattern that's available, but here's how they work. In between the actual focusing screen and condenser lens in each screen unit is a thin layer of plexiglass. Etched into it—in an overall pattern with center-weighted averaging screens, a small control rectangular pattern with selective-area screens, and a central circular dot with spot-metering screens—is a linear "corrugated" grid pattern incorporating a special coating. This pattern acts as a "micro" beam splitter,

allowing most of the light striking it to pass upwards to the finder, but deflecting a small portion of the light straight back through a small rectangular aperture at the back of the frame of each focusing screen unit. At the back of the mounted screen, in the camera body itself, is a matching rectangular port containing the SPD meter cell. The illumination for metering is thus funneled through the screen to the cell, and the metering sensitivity pattern can be varied according to the configuration of the micro beam splitter in each screen.

Exchanging screens is a simple matter. Slide off the prism or other finder, hook a stout fingernail into one of two notches at the rear of the screen-retaining "frame" in the camera body, pull up the screen unit, lift it out, insert the new screen (remembering to hook the front surface of the replacement screen in first) and push its rear section down. It mounts firmly with a light click and is held in precise alignment by a tab at the front and two spring-loaded fingers at the rear. This procedure does take a bit of getting used to, and folks with nonexistent or weak fingernails may require a pen knife or equivalent to exchange screens in the F-1. But overall, we judge this screen-interchange system to be one of the handiest and most secure we've encountered.

Since Canon's promotional literature touts these laser matte screens with considerable vigor, extolling their superior brightness, "focusability," and high performance focusing aids, we scrutinized them with particular care, and compared the F-1's finder side-by-side with the brightest, easiest-to-focus cameras we've previously tested. Our verdict: In terms of brightness, very few cameras on the market can equal the Canon F-1's finder/screen combo, and fortunately, the brightness has not been achieved at the expense of lowered contrast as it has been with other cameras. Also, the split-image rangefinder with surrounding micropism collar on both our test screens worked extremely well with a wide range of lenses, including ultra-wide-angles and long teles of moderate (f/4.5-5.6) apertures, providing decisive and repeatable focusing accuracy even under unfavorable lighting conditions. In short, the view through the F-1's viewfinder is undeniably one of the camera's most attractive features.

Since the Canon New F-1 is the only truly professional "system" SLR to provide a range of meter-sensitivity patterns, perhaps the following criticisms should be taken in context, but nevertheless herewith its shortcomings. Obviously, obtaining spot or limited-area metering by switching screens is less convenient than turning a dial to accomplish the same thing. And while the Leica R4 only provides for two meter-sensitivity patterns on its meter-mode dial, a pro working in dusty conditions, for example, would prefer not to have to remove the prism and switch the screen to do so. Also, Canon states in the F-1 instruction manual that spot-metering screens and even limited (12%) area-metering screens are not the best choice when using either of the camera's auto-exposure modes. Why? Because, despite its plethora of other useful features and clever engineering the F-1 lacks one significant feature found on many less formidable SLRs—a provision for taking a reading and holding the exposure. Oh, the exposure-mode dial on the back of the camera has a position marked "Hold" all right, but this just "holds" the meter

## RESOLUTION

| Canon 50mm f/1.4 #3360298<br>at 1:48 magnification |                    |    |                    |    |
|----------------------------------------------------|--------------------|----|--------------------|----|
| f/no.                                              | Center<br>Lines/mm |    | Corner<br>Lines/mm |    |
| 1.4                                                | Excellent          | 48 | Excellent          | 38 |
| 2                                                  | Accept.            | 54 | Accept.            | 38 |
| 2.8                                                | V. Good            | 68 | V. Good            | 43 |
| 4                                                  | Excellent          | 86 | Good               | 48 |
| 5.6                                                | Excellent          | 86 | V. Good            | 61 |
| 8                                                  | V. Good            | 68 | Excellent          | 68 |
| 11                                                 | Excellent          | 68 | Excellent          | 54 |
| 16                                                 | V. Good            | 61 | V. Good            | 48 |
| 22                                                 | Good               | 54 | V. Good            | 48 |

## CONTRAST

| Canon 50mm f/1.4<br>at 30 lines/mm |          |    |          |    |
|------------------------------------|----------|----|----------|----|
| f/no.                              | Center % |    | Corner % |    |
| 1.4                                | Low      | 34 | Low      | 22 |
| 2                                  | Low      | 49 | Low      | 22 |
| 2.8                                | Low      | 50 | V. Low   | 32 |
| 4                                  | Low      | 56 | Medium   | 46 |
| 5.6                                | Low      | 54 | High     | 54 |
| 8                                  | Low      | 54 | High     | 54 |
| 11                                 | Low      | 47 | High     | 56 |
| 16                                 | V. Low   | 39 | High     | 48 |
| 22                                 | V. Low   | 37 | High     | 48 |

on for 16 sec. and the meter needle moves if the light varies during that period. Given this state of affairs, Canon is indeed correct—the best screens to use in either auto-exposure mode are those designed for center-weighted averaging readings. If you can't take a selective reading and then hold it as you recompose the shot, even the limited (12%) screens may lead to poor auto-exposures if the main subject is not in the center of the viewing area. Our field test results bore this out—and it is, perhaps, the only major technical shortcoming of this otherwise superb camera.

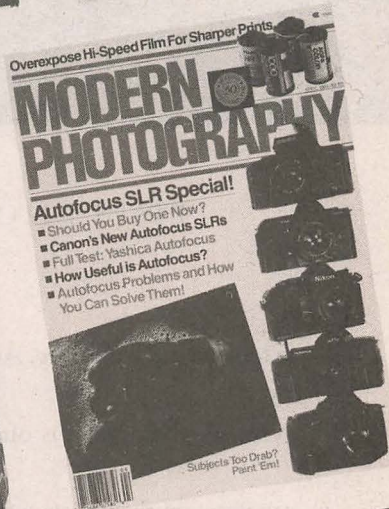
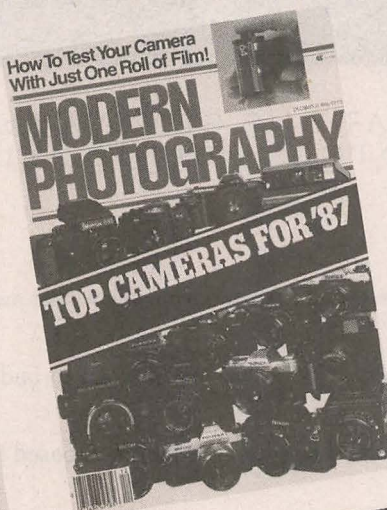
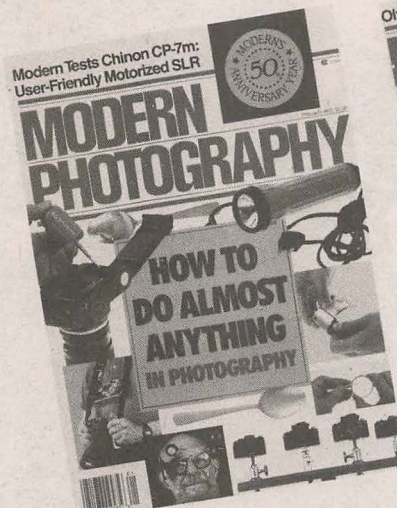
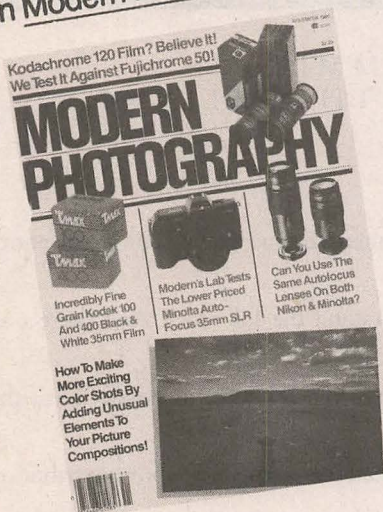
This brings us to the subject of auto-flash photography. Slide one of the half-dozen dedicated Canon units (or a compatible unit by an independent flash manufacturer) into the F-1's hot shoe and two wonderful things happen. As soon as the unit recycles, it automatically sets the camera to the 1/90 sec. flash sync speed. It's read out in the finder by the shutter-speed needle in the aperture-preferred mode and in shutter-preferred mode the aperture automatically sets the lens to the flash range f/stop you've set on the back of the flash unit. In match-needle mode you must set the aperture ring on the lens to the needle-indicated f/stop, but you needn't remove your eye from the finder—just turn the lens ring until the aperture pointer aligns with the meter needle. None of the above systems operate if the shutter-speed dial is set to B, and once you release the shutter, the camera automatically switches back to the speed set on the shutter-speed dial until the flash unit recycles and the pilot light glows. While this New CATS flash system will certainly cover the majority of flash needs, and fully manual operation is always available, there is no doubt that off-the-film flash metering (as found in the Pentax LX, Nikon F3, and Olympus OM-2n among others) is the preferable alternative since it's usable with all manner of macro and micro setups and will integrate overall flash readings from complex multi-flash lighting arrangements. No, it's not a crucial enough omission to negate all the many marvelous capabilities built into the Canon New F-1, but



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THIS PHOTOGRAPH DID ALL THE TALKING.

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we wish Canon had managed to sneak it in.

Despite its minor foibles, and because of its numerous examples of enlightened, straightforward thinking, the New Canon F-1 is clearly one of the finest, most competent and best built, and cleverly conceived single-lens reflex cameras we've ever tested. And it's sure to give its competitors a run for the money in the top-drawer professional SLR field. Though complex in design and construction it is essentially simple, reliable, and easy to understand in actual use. It offers the technical sophistication of multi-modes, but the elegant simplicity of one mode and one finder readout system at a time, and its ability to provide three useful metering patterns by changing screens is unique. Finally, its accessories—particularly the motor drive and winder—are engineered to complement the basic camera in an uncommonly felicitous way, actually enhancing its balance and handling while providing extended shooting and metering capabilities. Perhaps the nicest thing that one can say about the New Canon F-1 is that it is a camera that successfully upholds Canon's image as the world's leading camera maker and extends it to the toughest, most competitive segment of the market—the uncompromising, no-nonsense, put-up-or-shut-up realm of the working professional photographer.

**Optical bench analysis:** In the center of the image field at maximum aperture we observed very slight overcorrected spherical aberration, and slight red-purple flare. However, the image had a tight, bright core, characteristic of well-corrected optics; the flare was virtually absent by f/2.8 and nearly diffraction limited (perfect pattern) by f/5.6.

Toward the corners of the field, we noted moderate skew-ray flare at f/1.4, with slight astigmatism. The former aberration was reduced to very slight by f/4 and the latter was gone by f/5.6. The corner image was nearly diffraction limited by f/8, but very slight lateral color persisted.

**Field test slides:** In the center of the picture at f/1.4 we observed an overall softness and slight loss of detail, but by f/2 contrast and sharpness improved noticeably. By f/8 central image quality is superb. In the corners of the field at f/1.4 detail in on-film images was satisfactory, but the images looked soft. By f/4 contrast and sharpness improve markedly, and this high level of image quality holds at smaller apertures.

We noted somewhat higher than average flare in pictures shot with this lens at maximum aperture and at adverse shooting angles (back- and extreme-angle side light).

## Canon T70: Motorized, Computerized, Multi-Program 35mm SLR

### MANUFACTURER'S SPECIFICATIONS:

**Canon T70 35mm single-lens reflex. Body No. 1004648. LENS:** 50mm f/1.4 Canon FD in interchangeable bayonet mount, No. 6910535, apertures to f/22, focus to 18 in., accepts 52mm accessories. **SHUTTER:** Electronically-controlled, vertical travel electromagnetic attraction (EMAS) metal-blade focal-plane with speeds from 2 sec. to 1/1000 sec. and B, X sync at 1/90 sec., electronic self-timer. **VIEWING:** Non-interchangeable eye-level prism with split-image rangefinder, micropism collar, full area non-interchangeable screen. **OTHER FEATURES:** Auto loading. Two AA cells power auto wind, rewind, shutter mechanism and silicon photo cell metering circuit with cell above eyepiece. Dual cell measures either center-weighted or 11% central selective area for shutter-speed preferred, normal, wide or tele program auto-exposure mode, manual exposure or stop-down metered exposure. ASA 12-1600; out of range shutter-priority automatic speed shift, LCD panel atop camera indicates battery condition, film load, wind, film speed index, rewind, exposure mode, shutter speed, hand-hold speed limits, exposure limits, frame counter, bulb and self-timer second counter; finder LEDs indicate aperture set, program exposure warning, hand-holding and exposure limits, AE lock/selective area metering, manual exposure, flash ready and O.K. shutter-speed range in manual stop down metering mode, auto loading; hot shoe for dedicated, infrared pre-flash Canon autoflash units, remote control socket, removable eyecup, film box end reminder slot, built-in finger grips, shutter lock, provision for accessory data back with delayed interval release capabilities. **MANUFACTURER:** Canon Camera Co., Tokyo, Japan. **IMPORTER:** Canon USA, Inc., Lake Success, N.Y. 11040. **PRICE:** \$538.00 with 50mm f/1.4 Canon lens; \$470.00 with 50mm f/1.8 Canon lens.

For years many camera manufacturers have been eyeing what they consider a vast, untapped market—the photographer who wants to know little about photography and who wants to apply this lack of knowledge to the wondrous workings of the 35mm camera.

If you haven't already noticed, full electronic control of SLRs has been creeping up on little pushbutton feet ever since the Pentax ME Super of 1979. While that camera used two buttons only to control manual speeds, it was evident that other controls would inevitably succumb to the faster acting multi-use pushbuttons. The Canon T70 represents, however, not only a giant step ahead in electronic camera control but also demonstrates the wide variety of possibilities and conveniences that such control can provide. With a push of the right button or slide of the switch, metering patterns can be varied, exposures locked, ASA speed film changed, exposure modes shifted from shutter preference to any of three different program exposures in which

### 35MM Single Lens Reflex

the camera makes the choice of shutter speed and aperture. Further, an LCD panel atop the camera offers graphic displays of what the camera is doing in a manner akin to that of a computer screen. It is a bravura electronic performance, fascinating even just to watch. But as a "user friendly" picture making instrument, what may it have sacrificed? Has it evolved too far too fast? These valid questions we hope to answer as well as furnish you with our usual analysis of the camera's capabilities. But let's now begin where we must—at the beginning.

The basic configurations of the metal-bodied T70, whether discussing top, front or open back, are extremely close to that of the far less expensive, plastic bodied program-exposure-mode-only Canon T50 SLR. This might seem an odd parentage since the T70 is in no way a "bargain" or even a moderately priced camera. However, in terms of manufacturing rationalization—making the most of designer's and a factory's abilities—the T70 can be well understood. The T series cameras are Canons most sophisticated advances into the future. They comprise those Canons with auto wind, auto load and heavy use of electronic operations. By employing much the same configuration, many needed mechanical parts providing similar operations can be shared by more than one camera, therefore keeping costs down to the manufacturer and inevitably to the consumer as well. A quick glance at the lens tripping mechanisms and auto loading devices of both reveal the near similarities and bear out our contentions.

Battery replacement is efficient and simple. No coin edge, no fingernail. Just pressure from a finger and the solidly locked bottom cover of the chamber flips open to accept two AA cells. Rather than indicating battery polarity with pictographs on the chamber walls where they can't be seen easily, Canon has provided enameled indented + and - indicators on the metal springs of the cover which can be seen clearly even in poor light.

Loading is equally intelligent. Rather than pulling up on a rewind knob (not needed on this camera) a double catch on the camera end consisting of a button and slide lever can be managed nicely with a single finger. Then the back swings open. The film cartridge needs only a push into the chamber since there is no rewind spindle to raise out of the way. Move the film leader across the film plane making sure the leader perforations engage the sprocket teeth and close the back. (When the film leader is too long—and it sometimes is—you'll have to re-roll a bit into the cartridge.) Immediately a series of soft winds and clicks occur as the camera advances film to frame 1. If you happen to be looking at the top panel LCD you will be fascinated by the film cartridge pictograph which shows the film leader extending outwards from the cartridge and winding until a large frame 1 appears. Incidentally, the cartridge pictograph only appears if there is film in the camera, and the winding signal only occurs if the film is winding properly.

Now it's time to set the ISO/ASA index. Push the ISO button on the left side of the camera. The film speed indication appears on the LCD. To reach a higher index push the "up" button on the right side of the camera. Too high, push the "down" button. The ASA indices will change one after the other until you get the right numeral. Numbers available

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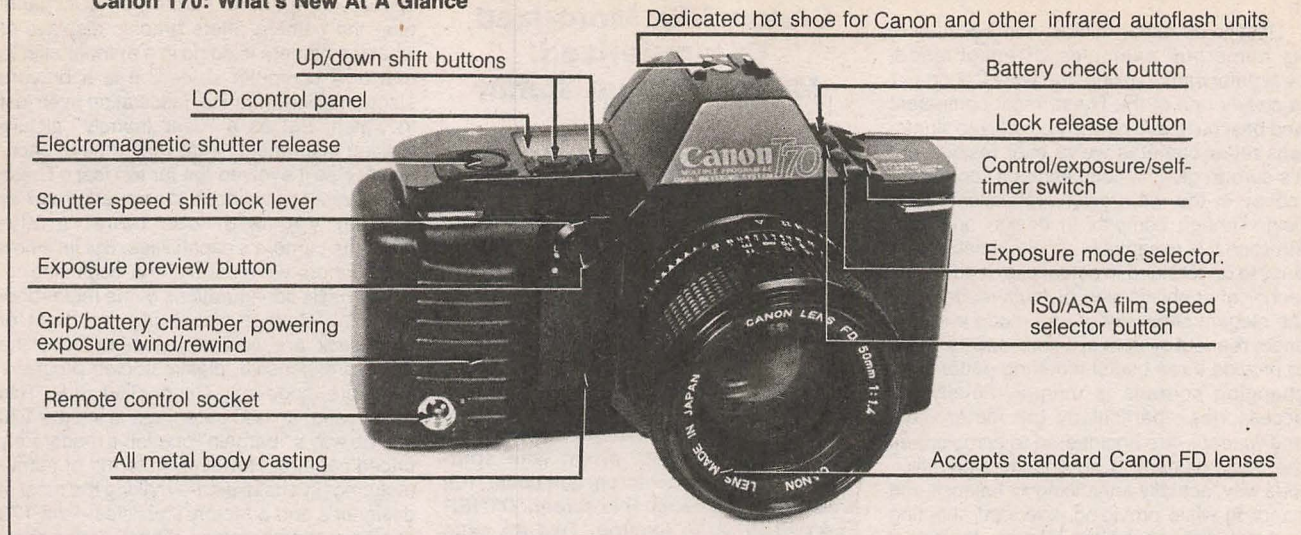
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## 35MM Single Lens Reflex

### Canon T70: What's New At A Glance



are 12, 16, 25, 32, 40, 50, 64, 80, 100, 125, 160, 200, 250, 320, 400, 500, 640, 800, 1000, 1250, 1600—just about anything you might possibly need. You can recall the ASA index as a reminder whenever you wish by pressing the ISO button.

For most photography you will probably want average, center-weighted metering. Slide the control lever to average. Now let's pick a program. Push down the mode button and press either the up or down button. In succession you will see the word program with tele, then program alone, program with wide and finally a smallish TV, only in the upper left portion of the LCD panel. The three programs do not mean that you must use the program-only with a normal lens, tele with all tele lenses and wide with wide lenses, but are more of an indication just what the program selection of both shutter speeds and apertures favors. The diagram on top, right corner shows the exact shutter speeds and aperture of all three programs (plus the behavior of the shutter-speed preferred auto exposure which we'll get to).

Basically the program-only is a compromise with shutter speeds and apertures rising equally on a 45° angle from 1/8 sec. The wide-angle program rises on an equal angle but starts at 1/2 sec. rather than 1/8 sec. providing two f/stops less lens opening or, in more practical terms, two f/stops more depth of field for any given light intensity. Ergo the wide program gives you greater depth of field but slow shutter speeds for any given light level. As might be expected the tele program does just the opposite, keeping the lens at full aperture all the way up to between 1/125 sec. and 1/250 sec. It then allows the lens to close rather swiftly at a steep diagram angle as light increases further. While tyros can certainly feel safe that they are usually getting the best programs for their shooting by matching wide-angle lens with wide-angle program and tele lens with tele program. More knowledgeable users will want to match the program more closely to their specific type of picture making.

The diagram indicates the programs for an f/1.4 lens, but you can easily figure out the programs for lenses with smaller apertures. Just enter the diagram at the left on the line indicating the maximum aperture of your lens and follow it horizontally until it bisects the program line. It then climbs the line just like

the f/1.4 lens program.

Just what information is the camera giving you in its program modes? Slight pressure on the shutter release or the front preview button causes the shutter speed selected to appear on the LCD panel atop the camera, while within the viewfinder a green P (for program) LED appears to the right of the focusing screen, along with the red digital aperture setting. The exposure will change and so will the numerals on the LCD and in the finder as light on your subject changes. When the lowest possible shutter speed at which you should hand-hold an exposure is reached (1/125 sec. or slower in tele program, 1/60 sec. in normal program and 1/30 sec. or slower in wide-angle program) the P within the viewfinder will begin to blink in warning. Should the exposure be completely outside the possible range of the T70, the aperture will also blink and the shutter speed will blink atop the LCD panel.

Now let's switch the mode to the TV setting already mentioned. This is the shutter-speed preferred mode in which you can choose your shutter speed and the metering system selects the aperture. Using the up and down buttons, any speed from 2 sec. to 1/1000 can be selected and will appear on the LCD panel while the camera-selected aperture appears in the viewfinder. But the shutter preference auto-exposure system has a neat trick up its electronic sleeve. If you select a shutter speed but there isn't enough light to shoot at that speed even at maximum aperture, the camera will shift the selected shutter speed downwards to reach proper exposure. In other words, if you pick 1/125 sec. for instance, and the camera needed an aperture larger than f/1.4 for proper exposure, the camera will shift your 1/125 sec. numerically downwards to 1/60 or further if necessary for proper exposure. When you press the shutter release slightly, the shifted speed appears on the LCD and the maximum aperture of the lens blinks in the viewfinder in warning. The same type of shift occurs if you've selected too slow a speed and the camera's minimum aperture isn't small enough. Then the speed will be shifted numerically upwards. Naturally if the exposure is beyond any possible shutter speed and aperture combination both shutter speeds and apertures blink.

We haven't exhausted all our exposure possibilities yet. With the camera still set to

TV (shutter-speed preferred), let's push the aperture release button on the lens and move the scale off "A" to manual aperture settings. Immediately an "M" appears on the LCD panel. Within the viewfinder a blinking red "M" lights. The viewfinder continues to show the correct exposure aperture. You can either match this on the aperture ring of your lens or vary it as you wish. However, you can't meter and set the camera manually at eye level. You must set the aperture while looking at the lens.

The camera can physically be set manually when in a program mode but it won't work properly. Keep it in the shutter-preferred mode for correct manual operation.

We have one more operational exposure mode. If you remove the camera lens to use the body with a bellows unit, with old Canon lenses (prior to the FD series) on a microscope or telescope, you must, of course, be able to make exposures at the microscope's, telescope's or the stop down aperture of the lens on the bellows.

When you remove the lens from the camera another auto-exposure mode becomes available: stop-down aperture. While the instructions don't say so, it's really an aperture-preferred exposure mode in which the camera sets the proper shutter speed for whatever working aperture the accessory has. A small stop down iris diaphragm pictograph appears on the LCD panel. The LCD panel shows the shutter speed to be set by the meter circuit. Within the viewfinder, the LEDs now read in shutter speeds from 2 sec. to 1/90. Then an H.L. appears indicating speeds from 1/125 sec. to 1/350 sec. With brighter light an H.H. lights up, meaning the speeds are from 1/500 to 1/1000 sec. If you wish to use manual speeds with stop down exposure, you can by shifting to the shutter-speed preferred auto exposure mode in which you can set whatever speed you wish. However, you can't meter in shutter-speed preferred auto exposure mode at stop down apertures.

So far all the exposure readings we've made have used center-weighted metering. But the T70 also offers a more selective central area reading in which the outer circle beyond the micropism indicates 11% of the total picture. This is for handling lighting situations such as backlight where you wish to exclude light outside the circle. With "selec-



tive area" readings the camera also provides an auto-exposure lock. Slight pressure on the shutter release or front preview button locks the exposure in place so you can make a closeup reading or you swing the camera away from its central reading to another composition while maintaining the same exposure (as long as you have finger pressure on the shutter release or preview button). When you press the shutter release fully, the camera will release at the exposure you've been holding. This is similar to the exposure memory hold levers or button on other SLRs. (The camera has no auto-exposure compensation dial.)

You can use the selective area metering with lock in any auto exposure mode by sliding the main switch to the partial (AEL) position. While there is no indication on the LCD panel that you're using the AEL, you can, of course, see it by looking at your main switch position. Additionally, a red asterisk warning does light in the viewfinder.

The camera is capable of making two additional types of exposure: self-timed and bulb. As you might expect from a camera like the T70, electronics are used in both to help furnish more information.

In any exposure mode, set the main switch to self-timer. Then press the shutter release. Immediately an audible beeper sounds and the frame counter of the camera shifts to indicate the 10 sec. countdown, second by second. From 2 sec. to the shutter's release the beeper will increase its beep speed to warn you and the subject.

To make exposures longer than the maximum 2 sec. of the shutter range, set the camera to the TV shutter-priority mode. Press the down button until the word "bulb" appears on the LCD panel. Set your aperture manually. Press the shutter release. The shutter will remain open as long as the button is kept pressed. However, the number of exposure seconds will be indicated for you on the lower right portion of the LCD panel. The numerals run from 1 to 30 seconds. After 30 sec. the numerals repeat but one of the film cartridge pictograph bars will appear indicating that 30 sec. has already been timed. Since there are three bars you can time exposures up to 120 sec. using the camera's built-in clock and visible timer.

A tyro certainly can be taught to run the T70 in a matter of minutes by setting the main camera switch to program and warning him/her to make certain nothing blinks in the finder. But the full capabilities of the T70 can only be realized by a user willing to sit down with the excellently written and illustrated 70-page T70 instruction booklet and spend the time ingesting all the camera's abilities which we have just enumerated. Is this too much to expect of the average photographer? We once thought so when the Canon A-1, an equally complex electronic camera appeared in 1978. However, its vast success and its many enthusiastic owners convinced us that photographers will bend their abilities to such a learning process.

Before we give you our careful analysis plus field and lab results on the T70, we must describe two important accessories which become part of the integral Canon system.

The T70 uses a dedicated, three terminal hot shoe flash system something like that of the T50, employing a pre-exposure infrared flash which measures the distance from camera to subject and back and sets the flash accordingly. With the new Canon 277T flash

this system yields very useful dividends. It automatically sets the T70's shutter to the 1/90 sec. flash sync speed, selects the proper aperture from f/2 to f/22 for the distance during the infrared preflash and finally sets the camera lens to this aperture, all automatically. Ergo, your normal lens will be set by the flash from f/22 to f/2 depending on the distance of the subject—quite unlike standard dedicated flash units which make use of only a limited number of apertures and which require you to make pre-exposure tests if you want to make certain that you have enough illumination. With the 277T, the pre-test takes place immediately before exposure. If an aperture is selected and shows in the viewfinder (and on the back of the flash unit) the light is sufficient. If you are out of range, the maximum aperture of your lens will blink in the finder and a red dot will pulse on the back of the 277T after the preflash. However, you can make a flash pretest if you wish by pushing the exposure preview button. If the flash unit and camera registers a useable aperture number, you can go ahead and shoot. However, the flash's ability doesn't stop at measuring an infrared flash distance. The front sensor measures ambient light at the same time so you can combine daylight or any other type of continuous light with electronic flash (provided of course the required shutter speed does not go over the maximum flash sync speed of 1/90 sec.).

How simple and accurate is this flash system in practical use? We'll check it carefully in our practical tests.

The T70's back can be removed quickly and replaced with the Command Back 70. The back is so comprehensive that a complete description equally as long as our camera report could probably be written about it. Suffice it to say that it is incredibly slim, adding only 3.4mm, 1 1/8 in. and 1/2 oz. to the camera and comes complete with the same thumb grip surface as the regular camera back. (You do lose the film box reminder slot, however.) Besides being able to record data such as date, time, picture number or 6-digit code on ASA/ISO 25, 100 and 400 film, the back can also command the camera to take pictures at time delays up to 23 hr., 59 min. and 59 sec., take pictures at intervals of the same range, make time exposures over the same range and/or combine any of these functions in any sequence you wish. An excellent 42-page instruction book accompanies the back. Power for the back is supplied by a 3-volt lithium disc-type battery which needs replacement about every four years.

The T70's motorized film advance was surprisingly quiet as was its shutter operation. Our tests showed that an entire roll of 36 frames could be exposed in 31.75 sec. or faster than 1 frame per sec. At film end, audible beeping warned that the film should be rewound. Canon's estimate of 40 rolls of film transported and rewound per set of batteries seemed slightly optimistic since camera advance did slow down as the batteries aged. We would advise battery replacement in 25-30 rolls—still an impressive number. Pressure on the rewind lever and button provided instant rewind completely into the cassette in 20 sec. We enjoyed watching the LCD panel indicate, in pictographs, the film rewinding and the frame counter counting downwards. When film is completely wound, the frame counter goes blank, the film leader in the picturegram disappears, the motor rewind stops and the pictograph of the car-

tridge itself begins to blink indicating that it should be removed. However, you can't stop the film from rewinding completely into the cartridge.

The laser-matte screen provided an extraordinarily bright viewing and focusing screen with a splendid split-image rangefinder which, like the excellent surrounding micropism collar, remained useable from maximum aperture down to f/5.6 (with lenses having that maximum aperture). The entire screen can be seen by eyeglass wearers complete with the right-hand side viewfinder signals. Thanks to the unique rubber eyecup, viewing with eyeglasses was easier than with any other SLR except the Canon T50 which has the same eyecup.

While the cataloging of the T70 features is indeed awesome, there are a few features which are absent. There is no depth-of-field preview, no provision for multiple exposures, no PC terminal for standard off-camera flash cords, no interchangeable screen provision. We have noticed that more and more cameras are appearing without depth-of-field previews, a useful feature, in our opinion. However, the absence of a PC terminal can readily be rectified by those needing one by using a shoe PC terminal adapter available from many stores. As for interchangeable screens, such a feature is more in keeping with a professionally oriented camera which the T70 isn't, being more in the role of a highly sophisticated camera for amateurs, advanced or otherwise.

In handling it would be nearly impossible to find a camera whose shape and placement of controls was better. The bulging, right-hand front finger grip and rear ribbed grip seem ideally suitable for almost everyone's hands. Loading operated properly 100% of the time. However, should you fail to pull the film leader across to the marked place and the film doesn't wind, the pictograph on the LCD panel shows a cartridge with no leader sticking outwards. Auto winding to the first frame was very useful. The T70 exhibited a body solidity we hadn't found in any new camera for years. Should you wish to use diopter correction lenses rather than your eyeglasses, the camera's rubber eyecup must be removed. However, we do recommend that you use your eyeglasses and not the diopter correction lenses if you are farsighted since you will not be able to view the top LCD panel without your glasses.

The digital LED information in the finder was extremely bright and usable when shooting in darkened areas—an admirable superiority over most other SLRs—and the display remained visible even in fairly bright sunlight. The information on the top LCD panel was the essence of legibility. But the separation of information between the top LCD panel and the viewfinder itself did cause us some difficulty. In order to set shutter speeds in shutter-speed preferred mode or to check possible automatic shift from the set shutter speeds in case of too much light or too little, you must remove the camera from your eye and look at the top panel. Likewise, you can't read the shutter speed set in any program mode without taking the camera from your eye. When you do remove the camera from your eye there is the danger that the reading on the panel won't be the same as when you are viewing the subject through the finder, with your eye up against the eyepiece.

We readily understand that all the informa-



## GENERAL PERFORMANCE

| Checkpoints                           | Our Standard                                                                                                                                                                                            | As Tested                                         |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>FINDER:</b>                        |                                                                                                                                                                                                         |                                                   |
| Apparent viewing distance             | Between infinity and 20 in. (0.5m)                                                                                                                                                                      | 33 in. (0.8m)                                     |
| Apparent distance of aperture scale   | Between 112 in. (2.9m) and 29 in. (0.7m)                                                                                                                                                                | 52 in. (1.3m)                                     |
| View area compared to film area       | Vertically and horizontally more than 90%, less than 100%                                                                                                                                               | Vertical: 92%<br>Horizontal: 90%                  |
| Parallax error compared to film       | Vertical: (1.0mm)<br>Horizontal: 1.8mm                                                                                                                                                                  | Vertical: 0.2mm (up)<br>Horizontal: 0.1mm (right) |
| Focusing accuracy at maximum aperture | Within depth of focus                                                                                                                                                                                   | No Discrepancy                                    |
| Image magnification                   | 0.85X $\pm$ 0.1X                                                                                                                                                                                        | 0.87X                                             |
| <b>PICTURE SIZE:</b>                  | 24 $\pm$ 0.6mm $\times$ 36 $\pm$ 0.9mm                                                                                                                                                                  | 24.4mm $\times$ 36.1mm                            |
| <b>SHUTTER:</b>                       |                                                                                                                                                                                                         |                                                   |
| Curtain travel evenness               | $\pm$ 0.33 stop                                                                                                                                                                                         | -0.16 stop                                        |
| Insulation from sync                  | More than 7 megohms                                                                                                                                                                                     | Infinity                                          |
| Sync contact efficiency               | More than 60%                                                                                                                                                                                           | 89% (hot shoe)                                    |
| Sync delay time                       | X: within full opening                                                                                                                                                                                  | Okay                                              |
| Shutter curtain bounce                | Not allowed                                                                                                                                                                                             | None                                              |
| Self timer delay                      | 7-15 sec.                                                                                                                                                                                               | 11 sec.                                           |
| <b>CAMERA SIZE:</b>                   | Body: 5 $\frac{1}{8}$ in. wide $\times$ 3 $\frac{3}{8}$ in. high $\times$ 2 in. deep (150 $\times$ 92 $\times$ 51mm)<br>Lens: 1 $\frac{1}{4}$ in. long, 2 $\frac{1}{2}$ in. diameter (43 $\times$ 61mm) |                                                   |
| <b>WEIGHT:</b>                        | Body: 1 lb. 3 $\frac{1}{2}$ oz. (565g) with batteries<br>Lens: 8 $\frac{1}{4}$ oz. (229g)                                                                                                               |                                                   |

tion on the top LCD could not possibly be placed inside the finder area but we would have wished the shutter speeds could have been visible within it. The remainder of the information, useful largely during pre- or post-shooting (such as loading info, frame number, mode and type of program) could remain where it is.

We had expected to find becoming accustomed to the pushbutton and lever controls difficult since we have for so many years operated with dials and rings. But we quickly became adept at the new way of changing functions and settings. Whether you can accept the convenience of the pushbuttons and switch vs. the possible satisfaction of twisting dials and rings will remain a personal decision. As with all cameras completely powered by batteries, we should point out that once batteries poop out (or in the few cases where there would be an electrical malfunction), the camera does become completely inoperable. Should this happen or should you change batteries, you won't lose valuable LCD panel information such as the frame counter number or film speed. The T70 has a camera-service-facility-replaceable, 5-year-life lithium battery located in a sealed chamber in the bottom of the camera.

Since it's a completely electronic camera, you won't find a standard mechanically-operated cable release socket on the T70. Instead it accepts a Remote Switch 60T3 which plugs into a three terminal switch on the T70's hand grip. We have found such electrical releases to cause far less camera vibration than even the best mechanical

cable releases.

Since the infrared preflash Canon 277T flash was introduced simultaneously with the T70 and appears frequently in T70 brochures and instruction booklets, would-be purchasers might wrongfully conclude that it is the only type of flash useable on the T70 and, conversely, that the 277 T can only operate on the T70. Neither assumption is correct. While the T70 can use the 277T or the simpler 244T introduced with the T50 last year, any regular Canon dedicated flash unit will operate on the T70, and the 277T can indeed work just as nicely and automatically on a host of other Canon's including the A-1, AE-1, F-1 and AE-1 Program.

However, since the 277T is a most interesting unit and has been coupled in literature with the T70, let's see how it works.

The unit is a four-AA-cell flash with coverage for a 35mm lens. An accessory panel broadens the coverage to the 28mm field. We found that the 277T provides not only aperture selection before the actual picture is shot using its infrared pre-exposure flash, but the camera's quenching circuit and silicon sensor then also measures the reflectivity of the subject and adjusts the duration of the flash during the exposure like most auto flash units. In Canon's dedicated flash system, a recycled flash unit not only shifts the camera's shutter speed to the proper sync speed (in this case 1/90 sec.) but also sets the proper aperture for the camera, indicating the aperture set in the viewfinder.

With ordinary dedicated flash units, (including Canon's) only a few apertures are

available which you must preset. But with the 277T there are 8 apertures from f/2 to f/22, from which the flash unit itself will select, so you will always get the best possible aperture to give you the most efficient flash and depth of field depending on the camera-to-subject distance. Conveniently, the aperture selected can be read right from the back of the flash even before the picture is made—an ingenious system. But should you wish to select your own aperture you can still use the 277T on the Canon T70 fully automatically. You just shift the control switch from Program to F No. Set mode, and push the F No. set aperture selector until the aperture you wish to use shows up as a bright red numeral on the back of the flash unit. In other words you can pre-select your aperture as on other auto flash dedicated units but you have a full set of 8 instead of a few. Now when you shoot a flash shot, the pre-exposure infrared flash will not go off since an aperture has already been chosen. Instead the unit will operate like a regular dedicated autoflash, adjusting its duration for proper exposure during the flash itself.

According to Canon's instructional booklet, the 277T provides a shooting range of from 1.6 to 41 ft. with an ASA 100 film, starting at f/22 closeup and using f/2 at maximum distance (there is no f/1.4 setting so the additional distance which an f/1.4 lens might give you isn't possible with the 277T).

How well do these systems work? We set up a controlled shooting range in the laboratory for Kodachrome 25. With the flash set to the program mode we made a series of photographs between 3.3 and 16.4 ft., the ASA 25 range as listed in the instruction book. But we wondered how well the relatively weak, pre-exposure infrared flash would work over long distances. We accordingly set up a 100 ft. range with tape measure and loaded the T70 with ASA 400 color slide film. According to the chart this might provide a range from 6.6 ft. at f/22 to 98.4 ft. at f/2. A series of photographs were made by MODERN's technicians at 3 ft., 5 ft., 10 ft. and then at 10-ft. intervals to 100 ft. At 50 ft. the pre-exposure aperture was f/2.8 and this aperture remained out to 100 ft.

When we received our slides back we found that exposures from 3 ft. to 50 ft. were properly exposed. Even when we moved the single subject to the side where most flash sensors would miss the subject completely the 277T's pre-exposure flash was able to pick up the right aperture. This is due to the unit's sensor wide angular response, which is across the field rather than a narrow angle as in other flash units. But slides made at distances beyond 50 ft. were clearly underexposed. The long distance was apparently beyond the infrared flash sensing unit's ability to measure accurately. We noticed that an ever so slight tilt upwards or downwards at long distances caused wide variations in the f/stop set. Apparently the reflections from the ground in the foreground itself prevented the unit from using apertures larger than f/2.8 when needed beyond 50 ft.

Our recommendation therefore would be to trust program mode exposure up to 50 ft. (35-40 if you want a safety margin) but to switch to F. No. Set for distances beyond that range. With the F. No. Set mode, you can select f/2 for maximum range. However, there is a fly in the flash unit ointment here. The unit has no flash range O.K. confirmation signal to let you know whether the exposure



## PERFORMANCE

| Our Standard                                                                      | as Tested             |
|-----------------------------------------------------------------------------------|-----------------------|
| <b>Focal length:</b> ±5%<br>(47.50-52.50mm)                                       | 50.17mm               |
| <b>Aperture:</b> ±5%<br>(f/1.33-1.47)                                             | f/1.42                |
| <b>Distortion:</b><br>(+/-1.5%)                                                   | less than 1% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 1.0 stops             |

## RESOLUTION

| CANON 50mm f/1.4<br>at 1: 50 |                  |    |                  |    |
|------------------------------|------------------|----|------------------|----|
| f/                           | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 1.4                          | Good             | 50 | Excellent        | 45 |
| 2                            | Good             | 50 | Excellent        | 45 |
| 2.8                          | Good             | 56 | V. Good          | 50 |
| 4                            | Excellent        | 71 | V. Good          | 50 |
| 5.6                          | Excellent        | 71 | V. Good          | 50 |
| 8                            | V. Good          | 63 | Excellent        | 56 |
| 11                           | Excellent        | 63 | Excellent        | 56 |
| 16                           | V. Good          | 56 | Excellent        | 50 |
| 22                           | Accept           | 50 | Excellent        | 50 |

## CONTRAST

| CANON 50mm f/1.4<br>at 30 lines/mm |                 |    |                 |    |
|------------------------------------|-----------------|----|-----------------|----|
| f/                                 | Center<br>( % ) |    | Corner<br>( % ) |    |
| 1.4                                | High            | 64 | High            | 38 |
| 2                                  | High            | 66 | High            | 40 |
| 2.8                                | High            | 78 | High            | 50 |
| 4                                  | High            | 82 | High            | 60 |
| 5.6                                | High            | 80 | High            | 72 |
| 8                                  | High            | 78 | High            | 70 |
| 11                                 | High            | 78 | High            | 69 |
| 16                                 | High            | 63 | High            | 58 |
| 22                                 | Medium          | 49 | High            | 45 |

was sufficient. While there is a chart of ranges in the instruction book there isn't one on the flash unit itself. We feel the 277T is an excellent choice for moderate flash ranges in the program mode particularly since it can also be used automatically with existing light for flash fill-in, but if you intend to use fast film at very long distances—over 35 ft. or so, perhaps you should consider another type of dedicated flash unit with a flash confirmation signal.

The 277T also has no provision for bounce flash nor can it cover lenses wider in angle than 35mm, other reasons you might want a different flash unit. For quick, easy, direct flash operation at moderate distances however, you can't beat the efficiency and ease of the 277T.

We regret the longish recital of flash tests, but the T70 and the 277T are sufficiently interesting and the instructions insufficiently clear so additional testing and reporting were necessary.

In the T70, Canon has used electronics to the utmost, providing amateurs with the most flexibility and ruggedness possible. Is it more your cup of photo tea than say a Canon A-1 or AE-1 program? Opinions were just as divided at MODERN as they will be among any group of photographers. The T70 is not a camera you pass with a shrug. It's a big step into the future. It remains to be seen whether you want to take the big step along with it. **Field test slides:** Images from the well known 50mm f/1.4 Canon lens showed good center sharpness and snap at all apertures. There was a slight central loss of contrast at

full aperture but it was only noticeable when compared to the middle aperture slides. Some loss of detail could be detected in the corners at large apertures but even the extreme corners held up well by f/4. Light falloff, apparent at f/1.4 was almost totally gone by f/2. Flare was well controlled throughout at all apertures. At close distances, images shot at apertures wider than f/2.8 showed some loss of detail but by f/2.8 they were crisp and snappy. We judged slides to be average or slightly above average for a fast normal lens.

**Optical bench analysis** (for optical experts only): On axis, slight uncorrected spherical aberration could be seen. Lens was diffraction limited by f/5.6. Slight red flare was present. Off axis, slight skew-ray and very slight yellow flare were observed. No lateral color was apparent. (July 1984)

## CANON T90: MOST FORMIDABLE 35mm PICTURE MAKING MACHINE EVER?

**MANUFACTURERS SPECIFICATIONS:** Canon T90 35mm single-lens reflex camera. Body No. 1001115. **LENS:** 50mm f/1.4 Canon FD in Canon breech-bayonet mount. **SHUTTER:** Electronically controlled vertical travel metal blade focal plane with speeds from 30 to 1/4000 sec. plus B. **EXPOSURE SYSTEMS:** Seven shiftable programs, shutter and aperture-preferred auto exposure both with safety shift, stopped down auto exposure, standard and stop down metered manual exposure. Dual concentric area silicon photo diode above viewfinder eyepiece measures light from focusing screen for centerweighted and central area metering. Silicon cell within mirror chamber measures light through lens for spot metering (averaging of up to 5 spot readings), ±4 stop highlight/shadow control, exposure lock, ±2 stop exposure compensation in 1/3 stop increments, metering range EV 0-20 at ISO/ASA 100. **FLASH:** Dedicated hot shoe provides through lens, off-film measurement plus infrared pre-flash auto-exposure control for auto exposure modes; spot metering and autolock capability, auto and manual fill-in flash balancing with highlight/shadow control, manual flash, provision for sync with first or second shutter curtains for special effects, sync speeds to 1/250 sec. **VIEWFINDER:** Fixed eye-level prism with interchangeable focusing screens. Standard E screen has central split-image rangefinder, micropism collar with spot-metering indication, outer central metering area circle, full focusing screen. Horizontal scale below screen shows segmented numerals and letters indicating shutter speeds and apertures with out-of-range flash warning, data imprint confirmation (with data back), error and help warnings, and AE lock. LED masked lighting shows manual indicator, flash charge and confirmation, exposure compensation warning. Vertical dot and digital scale at right indicates multi-spot metering, highlight and shadow control, remaining frames, flash-spot metering lock. All data can be illuminated. **OTHER FEATURES:** Three micromotors provide

## 35MM Single Lens Reflex

autowind (to 4.5 frames per second), auto rewind, shutter, mirror diaphragm cocking; autoloading with DX coding ISO/ASA 25-5000 with manual 6-6400 override, rear film identification window, molded hand-contoured body; body top LCD window shows shooting mode metering pattern, loading, winding, rewinding, confirmation, shutter speed, aperture, film speed, frame counter, self-timer operation time and battery check. Panel can be illuminated in low light, 2 or 10 sec. self timer, single or continuous shutter release, manual rewind button and battery check button all located behind door at camera body right; depth of field preview, built-in viewfinder blind, slide-on rubberized eyepiece, provision for multiple exposures, provision for data and command backs, wired and wireless remote control. **BATTERIES:** Four AA alkaline energizers, carbon zinc or nicad provide all power; built-in service-station changeable BR-1225 or CR-1220 lithium battery with approx. five yr. life provides memory backup. **PRICE:** \$702 with 50mm f/1.8 Canon; \$770 with 50mm f/1.4 Canon, \$920 with 50mm f/1.2 Canon. \$600, body only.

At first glance it might resemble a largish piece of black marshmallow fluff or maybe a high tech Black & Decker power tool. Then you grasp this large, sensuously contoured, SLR sculpture and everything begins to make sense. Few cameras before have felt so comfortable. Gone are the sharp corners and flat sides common to most other SLRs. This is a camera that fits like a glove, balancing beautifully with each control falling exactly where it should. The camera rests in your hand rather than requiring your hand to wrap around and adjust to it—an ergonomic marvel.

The top cover, traditionally a horizontal flat plate, has given way to sloping shoulders. A designer's affectation? You might think so until you are out in the sun and notice how the slanting glass cover over the generous 1 x 1½ in. LCD information panel reflects no sunlight and doesn't show your own face bouncing back from the surface.

You hold the T-90 to your eye. Whether you wear glasses or not, the removable soft, rubberlike, rectangular eyepiece cushions nicely. You see the whole brilliant view complete with all information. If you have eyeglasses, you can use their correction to view and focus without resorting to diopter corrections (which are available as extras for diehards). Farsighted photographers will be able to view through the finder and see the top of the camera without removing and replacing eyeglasses. The astigmatic photographer can have the use of his built-in eyeglass correction.

The view provides the same ultrabright, easy to see, red digital LED numerals for shutter speeds and apertures as were available on the Canon A-1—far more recognizable than LED lit numerals found on many other SLRs. However, finder magnification has been reduced from 0.83X to 0.77X in order to make viewing the entire screen, plus information, much easier.

Technically, the T-90 is just as audacious. Can a camera be equally suitable and manageable for a beginning photographer as well as an advanced amateur or professional? Impossible? But nevertheless, the neophyte can set program exposure and let the camera autoloading, set its own film speed,



## Canon T-90: What's New At A Glance



autowind and automatically rewind—just as in the simplest point and shoot camera. However, the professional will find a built-in 4.5 fps motor drive (powered by a superbly efficient system requiring but four AA cells as opposed to the six or eight that other SLR high-speed motor systems need).

Myriads of exposure options are all fully controllable: shutter- or aperture-preferred auto exposure; the instant choice of seven different exposure programs: three metering patterns including spot (2.7 percent of picture area), center-weighted and central area (the latter called "partial metering" by Canon and accounting for 13 percent of the area). Up to five spot readings can be averaged. The T-90 also provides exposure-memory hold and auto-exposure compensation, user variable highlight and shadow-spot control. (The serious amateurs and pros who yearned for film autoloading and were told that pro cameras simply "couldn't" now know that at least one pro camera "can".)

Old dog photographers brought up on turning shutter speed dials and aperture rings will admittedly have new tricks to learn—as they must with most sophisticated new electronic cameras. Luckily the "tricks," at least on the T-90, follow a very logical, easy to learn and understandable pattern. There are no horizontal dials to turn. The aperture ring remains at the "A" setting unless manual exposure control is required. Selection of which system you wish to adjust is made by pressing the appropriate button: meter pattern, exposure control, ISO/ASA override, multiple exposure, high or low film-advance speed, single or continuous picture taking. You hold down the proper button and turn the large vertical control wheel to change the setting: center-weighted, central area, spot reading; aperture priority, shutter priority, programs, bulb; ISO/ASA from 6 to 6400, up to nine multiple exposures, high (to 4.5 fps) or low speed (to 2 fps) film advance, auto exposure compensation (from 1/4X to

4X in 1/3 stop increments). You make changes within each category by releasing the button and turning the wheel itself, changing actual shutter speeds and apertures, for instance. Some changes in control require just the touch of one or two buttons.

One highly useful feature is the safety shift. You activate it by pressing, at the same time, both the ISO and exposure compensation buttons at the back of the camera. The camera will automatically shift the other exposure variable when you reach the end of the shutter speed or aperture range available in either shutter speed or aperture-preferred auto exposure. For instance, if you were using shutter-speed preference and had set 1/125 sec., light may have fallen below your maximum f/1.4 aperture. With SS in place, the camera would then begin to shift shutter speeds downwards automatically, to achieve a useable exposure—instead of just warning you by flashing the f/1.4 in the finder. SS is a most valuable feature in our opinion. We kept the SS on at all times.

Camera operation information is split into viewfinder readouts which show what you need to know during shooting, and top of camera LCD panel readings which you need in making decisions before you shoot. (The manufacturer's specifications at the start of this report list each informational area.) Generally, we certainly agree with Canon's division of information, but we did find the use of bars within the viewfinder to indicate number of frames yet remaining to be less useful than just plain numbers (which do appear when you get down to nine frames to go). Additionally, all frames-to-go warnings disappear when the vertical scale at the right in the finder is used for making spot readings. (But how many SLRs have any indications of the frame count within the viewfinder at any time?)

There are some other LCD panel pieces of information that one might like within the viewfinder so switches could be made while viewing the subject: changing metering pat-

terns, for instance. Still, what other SLR provides three such easily changeable patterns at all?

Let's get the T-90 underway. Slide the rear main switch from L to A. To open the camera for loading, press the opening button and move the lever on the side of the camera (a two-step operation to prevent accidental camera opening, yet easily accomplished, thankfully, with a single finger). The back swings open. Drop the film into the supply chamber, pull the leader across the film plane and shut the door. With a satisfying, fairly quiet whir, the T-90 quickly advances the film to frame one while the top LCD panel indicates proper loading, the DX coded ISO/ASA of the film and, when the motor stops, frame 1.

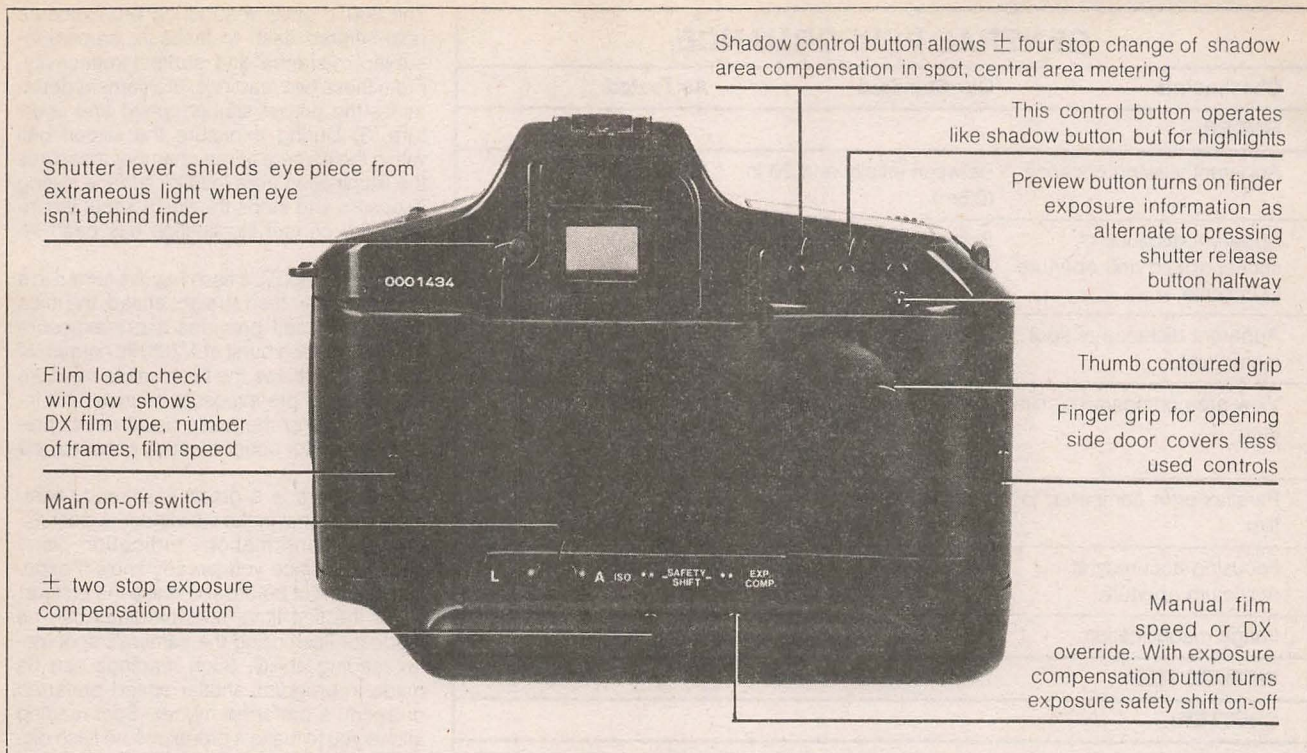
If loading hasn't been done properly (most likely cause: not pulling the leader sufficiently far across to the take-up mechanism), the loading pictograph on the LCD will blink in warning. If the film is not DX coded (almost all is now), ISO/ASA 6400 will blink wildly indicating you must set the index manually. Any settings that you made for the previous roll of film remain just as they do when you remove or replace the four AA batteries—thanks to the semi-permanent lithium memory battery (see manufacturer's specs for more on this lithium cell).

The viewfinder and LCD panels have three illuminating systems. The switch governing them is located inside a flush right hand door—along with other switches and controls that Canon feels are used less often and are best out of the way until needed.

The pictograph near the switch clearly indicates the illuminating possibilities: all finder information off, digital readout on and vertical scale illuminated from top of camera translucent panel and lastly, digital readout on, vertical panel and top of camera LCD panel illuminated by interior lighting (quite necessary when photographing at night or whenever it's dark directly overhead).

While the LCD panel remains on as long





as the main switch isn't at the L position, the digital numeral display and vertical LCD panel can only be seen when you press the shutter button slightly or push a button at the rear of the camera (the latter being preferable when you're changing settings at eye level). There is one way to keep the display on without maintaining pressure on the shutter release or rear button. When making multiple spot meter readings, you press a small button adjacent to the shutter release. This does cause the display to remain on without finger pressure for 30 sec., the same amount of time given for holding your spot-meter readings in memory before they are wiped. When set for internal illumination, the LCD panel light does go on automatically as you turn the control wheel, a useful touch.

While it would be nice to have the LEDs on constantly, it isn't practical because segmented numerical LEDs burn up battery power far faster than LCDs (as any owner of a Canon A-1 will attest). Therefore Canon, while providing the visible advantages of the LEDs, has attempted to prevent unwanted and inadvertent battery drainage caused by not turning off the display. (Of course the four AA cells of the T-90 are far less liable to become drained as quickly as the A-1's single 6 volt cell.) However, having the LED numerals remain lit (without finger pressure) for 30 sec. in all cases, and the LCD panels automatically turn on their interior illumination in poor light, would have been attractive solutions. Still, one shouldn't quarrel too greatly with what may be the most visible and complete finder information system extant.

In shutter speed and aperture priority auto exposure as well as in all program modes, exposure with center-weighted metering changes with the lighting conditions. But if spot or central area metering is being used, slight pressure on the shutter release or rear illuminating button not only turns on the metering system but also locks in the reading. It's important to remember this point. While

meter memory lock is very useful for making back-lit and similar readings, you could be misled into thinking the reading wasn't locked. In these two meter pattern settings, unless you are deliberately making central area or spot readings, it's advisable to release finger pressure and apply it again when you're ready to take the picture in order to minimize the time between taking the stored reading and making the exposure. Meter-memory lock readings should obviously only be made when the subject to be measured is in the center of the finder area.

Spot metering provides an intriguing number of possibilities for the knowledgeable photographer. Once you shift to spot readings, the vertical scale stops indicating frames yet to be shot and instead shows just an F (film loaded) at the bottom and a spot metering scale over most of its area. When you press the shutter release, you make a single spot meter measurement which will disappear when you shoot the picture or take your finger away from the release. However, if instead you push the adjacent spot metering button, the spot metering is held in memory at the center of the scale for 30 seconds even if you don't keep pressure on the button. The amount of variation from this spot reading can be seen by checking a second, moving bar indicating the illumination of other areas in the picture you wish to shoot. Press the button again and this reading too will be held in memory, shown on the scale, and the two readings averaged. The digital readout indicates the new averaged reading. Up to five readings can be averaged. If any one reading varies from the norm by over  $\pm$  four f/stops (and therefore beyond the capabilities of the film to reproduce it), small arrows at the scale's top and bottom warn you that the spread is too great.

The spot metering has an unusual additional feature: highlight and shadow control. On the few cameras having such a feature, the exposure variations usually represent fixed amounts of exposure compensation.

Not on the T-90. You determine your own amount of compensation up to  $\pm$  four stops by pushing the up or down highlight and shadow buttons on the back of the camera. We think the variable highlight and shadow-control buttons require quite accurate knowledge about the exposure latitude of each film and should be used only by those who have such or have done some experimentation with the T-90 as well as various films beforehand.

The T-90 can make aperture-preferred auto exposures in the stop down mode. Set the lens manually to the aperture you wish while in aperture-preferred, or any program mode, and push the depth-of-field stop-down lever. The digital readout within the finder indicates the shutter speed that will be set. Manual control is also possible, but regrettably without metering indication. To select full manual settings, set the LCD panel to shutter-speed-preferred auto exposure and the shutter speed you want. Now turn the aperture ring to the lens opening required. You must rely on your own judgment (or a separate exposure meter) for determining exposure in this case.

All previously available dedicated Canon autoflash units will operate with their own full dedication on the Canon T-90 (including Canon dedicated units made by other manufacturers). But not surprisingly, Canon has created a unique and highly sophisticated autoflash system for the T-90 alone, taking advantage not only of off-the-film flash measurement (first time for Canon), but also the existing light measurement, plus a near infrared pre-flash which measures the light reflected from the subject and sets both necessary shutter speed and aperture for proper exposure while balancing existing light (if present) with flash. Canon calls this system A-TTL (the "A" stands for "advanced"). To take advantage of this you need the new Canon Speedlite 300TL which sports five dedicated flash contacts instead of Canon's usual three.



## GENERAL PERFORMANCE

| Checkpoints                                               | Our Standard                                                                                                                                                                                            | As Tested                                         |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>FINDER:</b>                                            |                                                                                                                                                                                                         |                                                   |
| Apparent viewing distance                                 | Between infinity and 20 in. (0.5m)                                                                                                                                                                      | 52 in. (1.3m)                                     |
| Apparent distance of shutter-speed and aperture LED scale | Between 49 in. (1.2m) and 22 in. (0.6m)                                                                                                                                                                 | 39 in. (1.0m)                                     |
| Apparent distance of spot meter scale                     | Same as above                                                                                                                                                                                           | 39 in. (1.0m)                                     |
| View area compared to film area                           | Vertically and horizontally more than 90%, less than 100%                                                                                                                                               | Vertical: 93%<br>Horizontal: 94%                  |
| Parallax error compared to film                           | Vertical: 0.9mm<br>Horizontal: 1.08mm                                                                                                                                                                   | Vertical: 0.2mm (up)<br>Horizontal: 0.2mm (right) |
| Focusing accuracy at maximum aperture                     | Within depth of focus                                                                                                                                                                                   | No discrepancy                                    |
| Image magnification                                       | 0.77X ± .1X                                                                                                                                                                                             | 0.77X                                             |
| <b>PICTURE SIZE:</b>                                      | 24 ± 0.6mm x 36 ± 0.9mm                                                                                                                                                                                 | 24.3mm x 36.1mm                                   |
| <b>SHUTTER:</b>                                           |                                                                                                                                                                                                         |                                                   |
| Curtain travel evenness                                   | ± 0.33 stop                                                                                                                                                                                             | -0.2 stop                                         |
| Insulation from sync                                      | More than 7 megohms                                                                                                                                                                                     | Infinity                                          |
| Sync contact efficiency                                   | More than 60%                                                                                                                                                                                           | 80% (hot shoe)                                    |
| Sync delay time                                           | X: within full opening                                                                                                                                                                                  | Okay                                              |
| Shutter curtain bounce                                    | Not allowed                                                                                                                                                                                             | None                                              |
| Self-timer delay                                          | 7-15 sec.                                                                                                                                                                                               | 10 sec.                                           |
| <b>CAMERA NOISE:</b>                                      | 72dB(A), quiet for motorized camera                                                                                                                                                                     |                                                   |
| <b>CAMERA SIZE:</b>                                       | Body: 6 in. wide × 4¾ in. high × 2 <sup>11</sup> / <sub>16</sub> in. deep (153 × 121 × 69mm)<br>Lens: 1 <sup>11</sup> / <sub>16</sub> in. long, 2 <sup>7</sup> / <sub>16</sub> in. diameter (43 × 62mm) |                                                   |
| <b>WEIGHT:</b>                                            | Body: 1 lb. 15½ oz. (891g) with batteries<br>Lens: 7½ oz. (224g)                                                                                                                                        |                                                   |

The number of autoflash modes available using the 300TL is somewhat awesome. A tyro using the T-90 as a point and shoot camera (somewhat an absurd situation but nevertheless very possible), need only slide the mode button on the flash to the P (for program) position and that's that. When he turns on the flash and the green flash indicator shines in the finder, the flash will automatically shift the camera to program, no matter what mode it's in and the flash will operate in the A-TTL mode. Both shutter speed and aperture will be set for the flash shot. The settings will appear in the viewfinder when the shutter release is pressed slightly and the preflash goes off. If they blink on and off, the subject is out of flash range. The flash system automatically monitors both flash and existing light to give you a proper balance.

For more control over your flash destinies, you switch from program to mode position and push the button. With the A-TTL mode thus set you can still get the benefits of program exposure by setting the camera for it, but the advanced benefits of A-TTL are more visible if you use either shutter speed preferred or aperture preferred autoexpo-

sure and flash.

The purpose of using A-TTL plus shutter speed or aperture preferred automation is to allow you to set one or the other at precisely the speed or opening you wish and then get exact balance from the existing light present. However, should you set a shutter speed above 1/250 sec., the top sync. speed, the system will reset your shutter speed to 1/250 sec. If neither shutter speed nor aperture blink after the preflash your exposure will be correct and balanced with the existing light. If there is blinking in shutter-speed-preferred auto exposure, you had better reset to a slower shutter speed until blinking stops. In aperture-preferred auto exposure when there's any existing light present, you will often get proper exposure no matter what lens opening is selected. However, the shutter speed in low light may be very long indeed—up to 30 sec. A tripod may be called for but the result will inevitably be proper exposure even if the flash has little or no effect at all because you've selected a tiny aperture. The 300TL's flash exposure is determined by three measurements: 1) the T-90's centerweighted existing light metering measures overall scene illumination. 2)

The 300TL emits a subdued pre-exposure near-infrared flash to measure camera-to-subject distance and subject reflectivity. From these two readings, the camera determines the proper shutter speed and aperture. 3) During exposure the silicon cell within the camera mirror chamber measures the illumination from the film surface during exposure and stops the flash output the instant the correct illumination has been attained.

When the 300TL's flash head is turned in a direction other than straight ahead, the main flash tube itself provides a pre-exposure measuring flash burst of 1/20th its normal full output. This allows the flash unit to measure the effects of pre-exposure bounce flash instead of using the unit's usual direct pre-flash, which for bounce would, of course, be useless).

While there is a green flash-ready lighting bolt signal in the viewfinder, a post exposure confirmation indication isn't necessary since you already know if exposure is correct before you make the picture!

For the first time, spot readings can be made for flash using the camera's spot meter reading ability. Such readings can be made in program, shutter speed preferred or aperture preferred modes. Spot reading allows you to make a pre-exposure flash distance reading of a subject not in the center of the picture using 1/20th of the flash unit's main power. You can hold this reading for up to 30 sec. and release the shutter with any revised composition you want—a first time in SLR autoflash photography. Additionally, using the highlight and shadow buttons at the back of the T-90, you can vary the lighting ratio between existing light and the off-center main flash subject precisely as you wish. The spot flash reading is also useful if the main subject is centrally located but is rather small or against a contrasting light or dark background that might seriously affect a regular flash exposure reading.

Besides its automatic exposure modes, the 300TL also allows manual flash exposure of both high and low intensity.

Put succinctly, no camera and flash unit has ever offered such automatic flexibility. However, it's obvious that you must study and experiment to get the most out of this very comprehensive flash system.

The 300TL has a manually set rotating and bounce zoom head covering lenses from 24mm upwards, provides standard or automatic-off energy saving circuitry after five minutes of non-use, allows full or low-power autoflash illumination, is powered by four AA cells and can be combined with other Canon dedicated flash units for wired multiple autoflash.

The 300TL has another unique feature. You can set the flash to go off with either the first or second shutter curtain. Most flash units on other cameras go off as the first curtain opens. But if you are photographing a moving object with lights and want its flash image to appear at the end of the streaks of existing light, the flash must be synced with the second shutter curtain. A simple shift of a switch does it on the 300TL. Important? Not usually, but who knows when it might come in handy?

With ISO/ASA 100 film the 24mm setting in program mode extends from 18 in. to 41 ft. while at the 85mm flash head position you can get to 65 ft. Manual guide number with a 50mm lens and ISO/ASA 100 film is 114. Re-



cycling in auto flash modes varies from 0.2 sec. to 13 sec. with alkaline energizer batteries which provide between 100 and 700 exposures.

The flash provided excellent results with very good, even coverage. While one might argue that occasionally a good deal of calculation might come up with a better existing light—flash balance, by and large we were most pleased with results that we achieved in no time flat with no calculations at all. We unashamedly admit that program flash with the T-90 and 300TL system will be hard for any other camera system to equal, much less beat.

The pre-flash can require a bit of getting used to—for photographer and subject both. If you are operating fast, the pre-flash and flash itself occur almost simultaneously. However, if you want to make a pre-flash reading and then consider it before you make the final shot, the subject may be fooled into thinking the pre-flash was the exposure and just walk away.

The pre-flash silicon cell at the front of the camera covers about 18 degrees, about equal to the coverage of a 150mm lens. This would seem to be quite a good choice. However, to compensate for parallax (the fact that the cell is considerably above the camera lens position) it points down slightly. At most flash distances, the angled cell is of little consequence. However, at very great distances, beyond the flash's range, the cell can pick up reflections from the foreground, such as a road, and give an indication of correct exposure even if this wasn't possible (though we did find the claimed flash range to be conservative). If you do intend to shoot much flash at great distances or to mix high levels of existing light with flash, practicing with the T-90 and flash will ensure consistent results.

The pre-flash setting system has a nice additional advantage. Should one or the other of the controls—aperture or shutter speed—cause viewfinder numeral blinking, you needn't try to correct it and then take another pre-exposure flash. Instead you can hold the reading using the shutter button or pre-exposure readout button and turn the control wheel to a more equitable setting at which the numbers will cease pulsating.

In actual field tests, the T-90 behaved in an exemplary manner. We quickly learned that not only sequence shots but also single pictures were best handled in the "cont" (for continuous) mode. With advance set to the "single" position we found that it was necessary to take our finger off the shutter release button entirely before we could press it down again for the next exposure. In "cont," we were able to let up on finger pressure slightly after the initial shot was made and then bring pressure to bear again for the next shot. With a little practice, we could fire off single shots quite efficiently in this manner without shooting a sequence by mistake. In our tests we timed the high speed motor drive at 4.43 fps at high shutter speeds with fresh alkaline energizers. After about 30 rolls and much use of the exposure metering systems, top speed dropped to 3.5 fps. Ergo, if you need the highest speed, by all means use fresh batteries. The 2 fps setting when checked revealed the actual speed was 1.9 fps, quite acceptable. Rewinding a 36-exposure roll with fresh batteries required but 11 sec. and took place automatically following the last exposure on the roll.

## CANON 50mm f/1.4 LENS TEST

**Specifications:** 50mm f/1.4 Canon FD No. 6992682 in Canon breech lock-bayonet mount, accepts 52mm accessories; f/1.4 to f/22, half-stop detents plus automatic exposure A setting with lock; min. foc. dist. 18 in. (0.45m); 1 1/16 in. long, 2 3/8 in. diameter (43x61mm), 8 1/16 oz. (229g). Price: \$170.

**Practical comments:** Fine shiny black finish with large, clear numerals, footage scale in green; 9/16 in. wide rubberlike, patterned focusing ring goes from infinity to min. foc. dist. in 230 degree clockwise turn; exterior bayonet for additional lens accessories, traditional Canon ruggedness and smoothness of aperture ring and focusing.

**Field test slides:** Images were crisp and snappy with well rendered detail. Center sharpness increased markedly by f/2.8. Corner sharpness equalled center by f/4. Flare was well controlled throughout aperture range. Slight light fall-off toward edges and corners disappeared by f/2. Overall, an above average 50mm lens.

**Optical bench analysis** (for optical experts): On axis, very slight over-corrected spherical aberration was observed with some axial color. Diffraction limit was reached by f/8. Off axis, very slight coma was seen mixed with very slight astigmatism. Lateral color was minimal.

While the motor advance operates efficiently and quietly, having the camera whirl while rewinding by itself in a public place proved embarrassing. We would rather push a rewind button at our discretion. However, we could rewind film at our convenience before we reached the last exposure by pushing the rewind button under the right hand hinged cover. When rewind noise posed a problem if it occurred automatically, we stopped shooting after the next to last shot on the roll and then waited until we were out of earshot to rewind.

Film rewinds into the cartridge completely, leader and all. Leaving the leader end sticking out might have been more useful, particularly for those photographers who may shoot just a partial roll and would want to reload the same cartridge later.

Canon makes no claims as to the number of film rolls you can shoot on a single set of batteries. This number depends greatly on how much you use the metering systems with LED digital readouts and built in panel illumination bulbs, which do cause battery drainage. By simply loading film, winding and rewinding with a fresh set of batteries, we were able to go through over 90 rolls of 36-exposure film, with the batteries at the end still ready for more. Under average conditions, however (including metering, and lighting the information panels), we would expect a set of alkaline energizers to last through over 75 rolls. If the high-speed 4.5 fps meter is used for most of the shooting, about half as many shots can be expected. Standard alkaline manganese or nicad batteries would, of course, last for fewer rolls.

## 35MM Single Lens Reflex

### PERFORMANCE

| Our Standard                                                                       | as Tested      |
|------------------------------------------------------------------------------------|----------------|
| <b>Focal length:</b> ±5%<br>(47.50-52.50mm)                                        | 52.31mm        |
| <b>Aperture:</b> ±5%<br>(f/1.33-1.47)                                              | f/1.45         |
| <b>Distortion:</b><br>(±1.5%)                                                      | 0.46% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>(0-1.5 stops) | 0.5 stops      |

### CONTRAST

| CANON 50mm f/1.4<br>at 30 lines/mm |            |    |            |    |
|------------------------------------|------------|----|------------|----|
| f/                                 | Center (%) |    | Corner (%) |    |
| 1.4                                | High       | 50 | High       | 40 |
| 2                                  | High       | 54 | High       | 45 |
| 2.8                                | High       | 60 | High       | 50 |
| 4                                  | High       | 65 | High       | 54 |
| 5.6                                | High       | 69 | High       | 60 |
| 8                                  | High       | 71 | High       | 61 |
| 11                                 | High       | 58 | High       | 47 |
| 16                                 | High       | 50 | High       | 42 |
| 22                                 | Medium     | 47 | Medium     | 38 |

### RESOLUTION

| CANON 50mm f/1.4<br>at 50mm/1:50 |                      |    |                      |    |
|----------------------------------|----------------------|----|----------------------|----|
| f/                               | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 1.4                              | Good                 | 50 | Excellent            | 45 |
| 2                                | Good                 | 56 | Excellent            | 50 |
| 2.8                              | V. Good              | 63 | V. Good              | 50 |
| 4                                | Excellent            | 70 | Excellent            | 56 |
| 5.6                              | Excellent            | 70 | Excellent            | 63 |
| 8                                | Excellent            | 70 | Excellent            | 63 |
| 11                               | Excellent            | 63 | Excellent            | 56 |
| 16                               | Excellent            | 63 | Excellent            | 56 |
| 22                               | V. Good              | 56 | Excellent            | 50 |

Viewfinder brightness was commendable, with the excellent split-image rangefinder proving useable for lenses down to f/8. Changing focusing screens was about as difficult as with other cameras offering screen change through the mirror chamber—a procedure to be done with care using the tweezers furnished with each interchangeable screen.

All information centers—LED, LCD in the finder and the LCD atop the camera's cover proved highly visible and very useful. All controls operated well. We were very appreciative of the self-lighting LCD and finder panels when working in poor light, although even more illumination would make the top panel easier to read in extremely dim light.

We tended to keep our spot readings down to one or two. Needless to say, we solved many a tough lighting situation thanks to "spot," but found less use for "partial" center area readings. For most picture-taking, center weighting was fine. The body contours made handling the camera a real joy for our field-testers, had they small, medium or large hands. We had originally been querulous concerning the smoothish, satiny black hi-tech body finish but found that the sculptured gripping surfaces were more grippable than we expected. The protruding right-hand grip is superbly shaped with a slight ridge between second and third finger positions feeling "just right." The vertical hand grip has an excellent, rubberish covering, that is likewise easy to grasp. You will have no difficulty wielding the camera in one hand for both vertical and horizontal shots,



## 35MM Single Lens Reflex

but you may need your other hand to change some settings. The T-90 proved handy in shooting vertically whether the right or left end was upwards. The comfortable right hand grip is the best and most normal way to handle the camera, but we recommend that you avoid holding the camera by the left side only, as the smooth, tapered body may slide from your hand. The T-90 is a camera designed to work equally well for left-eyed as well as right-eyed users.

High marks go to the ribbed rubberish covering of the T-90's bottom plate. It gripped the tripod platform securely without the usual danger of the camera accidentally turning on the tripod head. Thankfully, the tripod socket is located amidships.

We were skeptical about the practicality of having seven user-selectable programs. It would seem necessary, we thought, to carry a small chart of the programs for reference. Doing so, however, would run contrary to the very reason for program exposure—to make shooting simpler.

We kept the T-90 on the standard program most of the time. However, when we used a tele lens, which might benefit from a faster shutter speed (at the expense of lens opening, of course), we would dial in the P-1 tele program to minimize the effects of camera shake. We could immediately see the shutter speed-aperture combinations available. Speeds still not fast enough? Go to P-2 tele, and if all fails, try P-3 tele. We operated in like manner with the wide angle lenses and P-1, P-2 and P-3 wide programs. And if we wanted to cross over and use tele programs with wide-angle lenses and wide programs with tele lenses for some specific reason, we could do that, too. Apparently, Canon's philosophy is to allow photographers their own program choice rather than having the lens automatically determine the program as in other camera systems.

Like many modern electronically operating cameras, the T-90 has no provision for a traditional cable release, but it does accept various lengths of electrical cable switches and wireless remote controls. A user must make certain to carry an electric release in his camera bag, since the old wire cable release won't work.

We missed having a body PC terminal for off-camera flash. You can add a sync cable from the hot shoe but this isn't quite as elegant or convenient.

Unusual for these days, the T-90 is a silent camera-without beeping warnings for slow non-hand-holdable speeds, self-timer operation or battery check found on other cameras. A few beeps might be in order for the T-90—with a turn-off switch.

We also noted that there was no mirror lock-up, once a common feature on top SLRs, but now falling out of favor as cameras have more efficient shutter- and mirror-action damping to minimize camera vibration. Nevertheless, for specialized high magnification work such as photomacrography we still prefer a mirror lock-up. It is, however, worth noting that the bulk and weight of the T-90 seemed to serve as an additional cushion against vibration.

Quite frankly, we had expected the additional bulk and weight of a 4-battery powered camera incorporating 3 motors to prove an annoyance for field use. It didn't, because the camera handled so well. Photographers accustomed to working with two camera bodies, however, may have more

size and weight than they wish (but still less than any other high speed motor drive camera).

We found more use for the 2 fps motor drive setting than the 4.5 fps. For family action, it was fine for sequences. However, for quick-action sports—diving, field events—the 4.5 fps really proved its worth. Other photographers watching us operate the T-90's motor were surprised by its quietness.

It should be evident that we are highly enthusiastic about the concept, convenience, flexibility, design and performance of the T-90, though we did find some minor omissions. Even those who might insist on owning a camera with autofocus could very well find in the T-90's considerable attributes sufficient reason for shelving that specific requirement. (July 1986)

## CHINON CP-7m: UNIQUE MULTI-MODE SLR

**MANUFACTURER'S SPECIFICATIONS:** Chinon Cp-7m 35mm motorized multi-program single lens reflex camera. Body No. 342032. LENS: 50mm f/1.4 Auto Chinon in interchangeable universal K bayonet mount. SHUTTER: Electronically controlled Copal vertical travel metal blade with speeds from 8 sec. (15 sec. in AE mode) to  $\frac{1}{2000}$  sec. plus B. VIEW-FINDER: Non-interchangeable eye-level prism, central split-image rangefinder, micro-prism collar, full focus screen; digitally lit LEDs indicate program in use, camera-selected shutter speeds, underexposure warnings plus flash ready and confirmation signals. EXPOSURE SYSTEM: Single silicon photodiode (SPD) atop the pentaprism provides through-lens (TTL), centerweighted metering. Manually selected normal, high and low speed autoexposure programs, aperture priority autoexposure, metered manual, autoexposure compensation,  $\pm 4$  EV in  $\frac{1}{2}$  stop increments. Metering range EV1 to 20 at ISO/ASA 100 with f/1.4 lens, DX and manual film speed settings from ISO/ASA to 5000. FLASH: Two-pin hot shoe dedicated flash provides flash ready and autoexposure confirmation signals; sync at  $\frac{1}{100}$  sec. with dedicated flash,  $\frac{1}{60}$  sec. or less for non-dedicated units and manual modes. OTHER FEATURES: Multiple-exposure provision, shutter lock, cancellable variable delay electronic self-timer and intervalometer, built-in contoured handgrip, single and continuous film advance, exposure mode reset button, LCD readout screen program chart, auto-wind and rewind, AE memory lock, backup memory condenser, provision for data back. BATTERIES: 4 AA cells (provided) or 1 2CR5 lithium cell (not provided). PRICE: \$616 with 50mm f/1.4 Auto Chinon, \$470 body only.

Ever since the introduction of the Canon T-70 with full electronic control, camera designers have been challenged to create cameras that are electronically advanced without seeming to be threatening to photographers who are computer novices. Chinon's response is the new CP-7m, a functional, stylish, medium-priced SLR with a fetching combination of multi-mode auto-

mation, manual capabilities, plus a distinctively designed major control switch.

The CP-7m bears little resemblance to its most recent predecessor, the Chinon CP-6, and indeed, is so different that there's no reason to compare the two. Most knobs and dials have been replaced by innovative switches, buttons and a large LCD readout screen. There is a unique multi-mode toggles switch—when you press a corner, all information needed for that mode will appear on the LCD screen in the same physical position as on the switch (more about this later). Such features help to make the CP-7m "user-friendly."

At first look the CP-7m seemed a tad clunky, with its largish rubberized grip and side-heavy feel, but it proved to be much more comfortable and convenient than expected.

Turn the camera upside down, open the battery compartment, and prepare yourself for a bona-fide first: Although the CP-7m can use four conventional AA cells, it also is operable on one 3-volt lithium battery, the first motorized 35mm SLR with this feature. The lithium advantages—lower temperature tolerance and longer shelf life (five to ten years)—should not be overlooked by those who store their cameras unused for long periods of time (although the battery should be removed and stored separately if the camera isn't going to be used for more than a month or two).

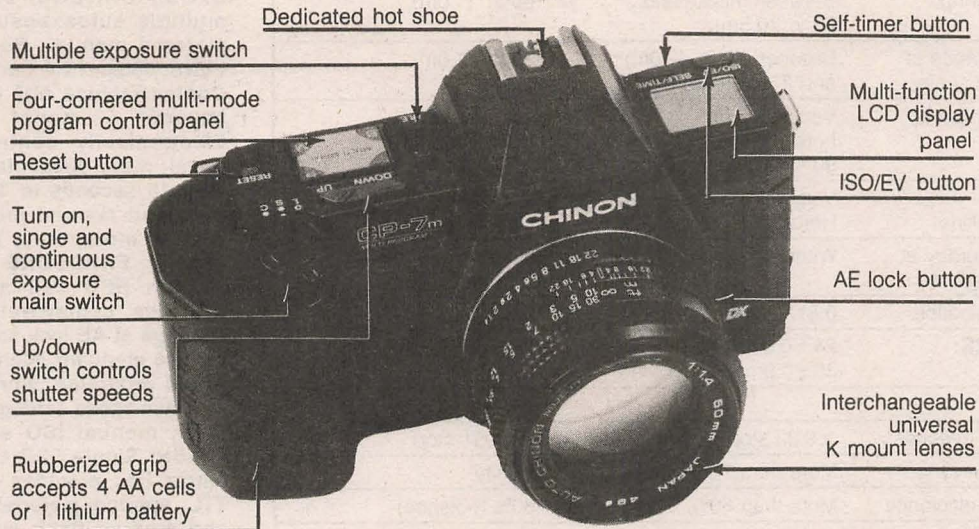
The power switch, a three-position ring around the electro-magnetic shutter release, is on a slant towards the forward section of the rubberized handgrip. Although the grip looks awkward to hold, the shutter release is within convenient, comfortable reach. Setting the control ring to L locks the shutter release. Turn the ring to S (single-frame advance) or C (continuous film advance at two fps) and the LCD screen to the left of the prism on the top plate comes to life, displaying mode indication, frame number, and an automatically set film speed plus DX indication.

On the CP-7m's right top deck is a touch-setting mode panel. It almost looks like an LCD screen but is really a four-way toggle-switch. To set the camera's exposure mode, press the corner of the panel marked with the appropriate letter. A selects aperture-preferred automatic, B provides bulb, M is manual, and the P setting offers a choice of three program modes. The panel clicks each time you press it, and the letter you press appears in the LCD screen at the same position as on the switch.

One press at P and you're in normal program. A second press at P and you are in the high-speed action program. The word ACTION appears next to the P mode indication on the LCD panel. Press P a third time and the camera shifts to the smaller aperture, slower shutter speed creative program mode, which maximizes depth of field. The word CREATIVE now appears next to the P. In all these modes, the vertical scale at the left side of the finder picture area lit from the rear by LEDs will show the shutter speed and exposure mode: P (standard program), PA (action program), PC (creative program) in green, A in red for aperture-preferred autoexposure. The shutter speed numerals are green down to  $\frac{1}{60}$  sec. Below this to one sec., speeds are in yellow to indicate that you should use some support to prevent camera shake. There is no finder indication



## What's New at a Glance: Chinon CP-7m Multi-program



that your lens may be set to an aperture other than the green-coded minimum aperture setting necessary for program exposure. But even if it's not, you'll still get the proper exposure, though the program will be limited to apertures equal to or wider than the one you've set.

The lack of an aperture scale or indication in the viewfinder or on the LCD screen is understandable, if regrettable, since Chinon cameras use widely available K-mount lenses, which are not keyed to transmit aperture information into the camera. K-mount lenses can be had from many independent manufacturers, which adds considerable flexibility for the owner when buying lenses. (Using the K-compatible Ricoh KR mount would have provided aperture readability but that is a Ricoh patent and may not have been available to Chinon.)

Aperture-preferred autoexposure selection is predictable: press the A corner, turn the lens to the aperture you want, and the camera will set the proper shutter speed.

For manual exposure control, press M on the multi-mode panel. Slight pressure on the shutter release now turns on the viewfinder display and a red M appears in the viewfinder scale. The proper exposure shutter speed in the finder will shine steadily. You can follow the suggested exposure or either press the up/down control to the left of the shutter button or change the aperture until you reach the exposure you wish. You can, of course, bracket your exposure manually in this manner, a flexible and convenient form of manual exposure control.

Autoexposure correction to handle such things as backlight is available, but the system is not for the fumble-fingered. Suppose you want to alter your exposure in the program mode while shooting with Dx-coded film. First, press the ISO/EV button, adjacent to the LCD screen. An 0.0 will appear at the bottom of the screen. While pressing the ISO/EV button, you must press the up/down button with your free hand. These digital calisthenics will let you set autoexposure compensation  $\pm$  stops in  $\frac{1}{2}$  stop increments.

For autoexposure compensation with non-DX coded film, just change the ISO/ASA by pressing the same buttons.

The CP-7m, unlike most DX-capable cameras, automatically sets the film speed to that of the last roll in the camera when you use a non-DX coded roll. Most DX-capable cameras available will automatically default to the ISO/ASA 100 setting.

The self-timer is unique. In any mode except B, press the self-timer button (adjacent to the screen). The screen shows the self-time duration as ten sec. You can change the self-timer delay, however, by pressing the up/down control. The self-timer delay can be set from one sec. to 60 sec. in one second intervals and one min. to 90 min. in one minute intervals. You can take interval pictures automatically with a locking cable release. Set the self-timer to the interval you want, press the cable release and lock it. The camera will automatically expose at the preset intervals until the unlock the cable release. You can cancel the self-timer in mid-countdown by pressing either the mode reset button (located to the right of the multi-mode panel and easier to push if you have fingernails) or the ISO/EV button. On B, with the same controls, you can make time exposures up to 90 min.

You can produce an unlimited number of exposures on the same frame by pushing the M.E. (multiple-exposure) switch, found on the top plate just to the right of the prism. Remember to turn the switch off, or you'll end up exposing indefinitely on one frame. However, to remind you that the multiple exposure control is operating, the frame counter on the LCD panel blinks for 12 sec. after each exposure.

Using the AE lock, located on the left side of the lens mount, is slightly cumbersome. In A mode, focus on your subject, press the AE lock and push the shutter release button halfway. Your metered exposure is now locked in. you are free to move the camera around and recompose, but don't take your finger off the AE lock button. If you do, the AE lock is off. We would have preferred a

locking switch on this control, which could leave your left hand free. Nevertheless, the AE lock feature will be welcome in such instances as making closeup readings in backlit situations.

Instead of incorporating a separate, factory-only changeable lithium cell, found in many other SLRs, the CP-7m has a unique condenser for memory backup. The condenser stores frame number, film speed, exposure mode, EV and shutter speed for up to five hours after the main batteries are removed. This is most useful when changing the main batteries.

Autoloading is quick and easy. Place the cartridge in the film chamber, pull the leader across the film plane until its end coincides with a yellow mark to the right of the take-up spool, close the back and the camera winds the film to the first frame automatically. When you've finished your roll, slide open the door protecting the rewind button and press. The autorewind will wind film completely into the cartridge, unlike some other autowind cameras.

During field tests, the CP-7m performed admirably. Its viewfinder provides a focusing image of average brightness and contrast with most of the field visible to eyeglass wearers. While some of its unusual controls require familiarization, we found the most frequently used ones are well placed and easy to master. Autowind was the quietest in comparison to other autowind SLRs we've tested.

The motor drive provides a true two fps speed in the continuous exposure (C) setting, according to our tests. The shutter release takes only a light touch to activate the LCD information panel but offers just enough resistance when actually shooting to prevent you from accidentally exposing a frame when you are just trying to read the panel's information.

Overall, how did the Chinon CP-7m make out? We feel Chinon has added a multitude of useful electronics while sacrificing little. The advantages of motor-wind, multi-modes and improved readouts, in our opinion,



## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                                       | As Tested                                        |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                                    |                                                  |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                 | 39 in. (1.0m)                                    |
| Apparent distance of shutter-speed scale | Between 79 in. (2.0m) and 26 in. (0.7m)                                                                                            | 39 in. (1.0m)                                    |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                          | Vertical: 92%<br>Horizontal: 93%                 |
| Parallax error compared to film          | Vertical: 0.9mm<br>Horizontal: 1.2mm                                                                                               | Vertical: 0.2mm (up)<br>Horizontal: 0.2mm (left) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                              | No discrepancy                                   |
| Image magnification                      | 0.87X ± .1X                                                                                                                        | 0.92X                                            |
| <b>PICTURE SIZE:</b>                     |                                                                                                                                    |                                                  |
|                                          | 24 ± 0.6mm X<br>36 ± 0.9mm                                                                                                         | 24.1mm x 36.1mm                                  |
| <b>SHUTTER:</b>                          |                                                                                                                                    |                                                  |
| Curtain travel evenness                  | ± 0.33 stop                                                                                                                        | -0.051 stop                                      |
| Insulation from sync                     | More than 7 megohms                                                                                                                | Infinity                                         |
| Sync contact efficiency                  | More than 60%                                                                                                                      | 80% (hotshoe)                                    |
| Sync delay time                          | X: within full opening                                                                                                             | Okay                                             |
| Shutter curtain bounce                   | Not allowed                                                                                                                        | None                                             |
| Self-timer delay                         | 7-15 sec.                                                                                                                          | 10 seconds                                       |
| <b>CAMERA NOISE:</b>                     |                                                                                                                                    |                                                  |
|                                          | 60 dB(a), very quiet for a motorized SLR                                                                                           |                                                  |
| <b>CAMERA SIZE:</b>                      |                                                                                                                                    |                                                  |
|                                          | Body: 6 in. wide X 3 1/2 in. high X<br>2 1/4 in. deep (153 X 89 X 57mm)<br>Lens: 1 1/2 in. long, 2 3/8 in. diameter<br>(38 X 61mm) |                                                  |
| <b>WEIGHT:</b>                           |                                                                                                                                    |                                                  |
|                                          | Body: 1 lb. 5 1/2 oz. (611g) with batteries<br>Lens: 7 1/2 oz. (214g)                                                              |                                                  |

outweigh the loss of traditional knobs and dials, and are easy to learn. Has Chinon successfully made a user-friendly, computer-controlled camera? We think they have. (January 1987)

## 50mm f/1.4 AUTO CHINON LENS

**Specifications:** 50mm f/1.4 Auto Chinon lens, No. C671952; Chinon Universal K bayonet mount, accepts 49mm accessories; f/1.4 to f/22 with half-stop click detents; min. foc. dist.; 1.5 ft. (0.45m); 1 1/8 in., 2 1/4 in. diam., 7 1/2 oz. (214g). \$146.

**Practical comments:** Well made, smooth operating, finished satin black barrels with green smallest aperture indication. Rubberized, easy to grip 5/8 in. wide focusing ring.

**Field test slides:** Images were crisp and snappy with detail well rendered. The corners were slightly soft wide open, but the corners equalled center sharpness by f/4. Flare was well controlled at all apertures. Slight corner brightness falloff at maximum aperture was gone by f/2. Overall average performance for a fast normal lens.

**Optical bench analysis** (for optical experts only): On axis, we saw very slight overcorrected spherical aberration. Very slight red flare was gone by f/5.6. Diffraction limit was reached by f/11. Off axis, we detected very slight skew-ray flare mixed with very slight astigmatism to f/16. Slight lateral color was present.

## PERFORMANCE

| Our Standard                                                                       | as Tested      |
|------------------------------------------------------------------------------------|----------------|
| <b>Focal length:</b> ± 5%<br>(47.50-52.50mm)                                       | 52.00mm        |
| <b>Aperture:</b> ± 5%<br>(f/1.33-1.47)                                             | f/1.46         |
| <b>Distortion:</b><br>(± 1.5%)                                                     | 0.47% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>(0-1.5 stops) | 0.3 stops      |

## RESOLUTION

| CHINON 50mm f/1.4 at 1:50 |               |               |           |    |
|---------------------------|---------------|---------------|-----------|----|
| f/                        | Center (l/mm) | Corner (l/mm) |           |    |
| 1.4                       | Good          | 50            | Excellent | 40 |
| 2                         | Good          | 56            | Excellent | 45 |
| 2.8                       | V. Good       | 63            | V. Good   | 50 |
| 4                         | Excellent     | 70            | Excellent | 56 |
| 5.6                       | Excellent     | 80            | Excellent | 63 |
| 8                         | Excellent     | 70            | Excellent | 56 |
| 11                        | Excellent     | 63            | Excellent | 50 |
| 16                        | V. Good       | 56            | Excellent | 50 |
| 22                        | Accept        | 50            | V. Good   | 45 |

## CONTRAST

| CHINON 50mm f/1.4 at 30 lines/mm |            |            |        |    |
|----------------------------------|------------|------------|--------|----|
| f/                               | Center (%) | Corner (%) |        |    |
| 1.4                              | Medium     | 44         | Medium | 30 |
| 2                                | Medium     | 43         | Medium | 32 |
| 2.8                              | High       | 58         | Medium | 44 |
| 4                                | Medium     | 53         | High   | 45 |
| 5.6                              | Medium     | 50         | High   | 46 |
| 8                                | High       | 59         | High   | 49 |
| 11                               | High       | 52         | High   | 43 |
| 16                               | Medium     | 47         | Medium | 37 |
| 22                               | Low        | 38         | Low    | 28 |

## CONTAX 167 MT: CLASSY HIGH TECH

**SPECIFICATIONS:** 35mm SLR with multiple autoexposure modes plus metered manual. Body No. 011354. **LENS:** 50mm f/1.4 Carl Zeiss Planar in Contax/Yashica MM interchangeable bayonet mount. **SHUTTER:** Electronically controlled, vertical-travel, metal focal-plane with speeds from 16 seconds to 1/4000 second in auto and manual modes, plus B in manual mode only, X sync at 1/125 second. **EXPOSURE SYSTEM:** Two-section SPD cell above eyepiece provides center-weighted or spot readings at AE lock setting; AE modes include standard, high speed, and low speed programs, shutter priority; DX auto film speed setting for films ISO 25-5000, manual ISO settings 6-6400. **FLASH:** Single SPD cell at bottom of mirror box provides center-weighted TTL, aperture-preferred TTL autofocus and manual flash auto sync speed setting with dedicated flash units. **VIEWFINDER:** Fixed eye-level pentaprism with central split-image rangefinder, micropism collar, full focusing interchangeable screen; LCD atop viewing area displays exposure compensation, shutter speed/film speed, set aperture, frame counter, (or elapsed time at B setting, or self-timer countdown), spot metering mark, AE lock i use, flash ready-light and exposure confirmation signal. **OTHER FEATURES:** Integral autowinder has single frame, continuous run (to 3 fps) and electronic self-timer settings, automatic exposure bracketing, top-mounted LCD panel displays same settings as in-finder LCD plus shooting mode, film rewind mark. Self-timer LED, provision for data back. **BATTERIES:** Four 1.5 volt AAA batteries power all operations; built-in lithium cell provides memory backup. **PRICE:** \$1,010 with 50mm f/1.4 lens.

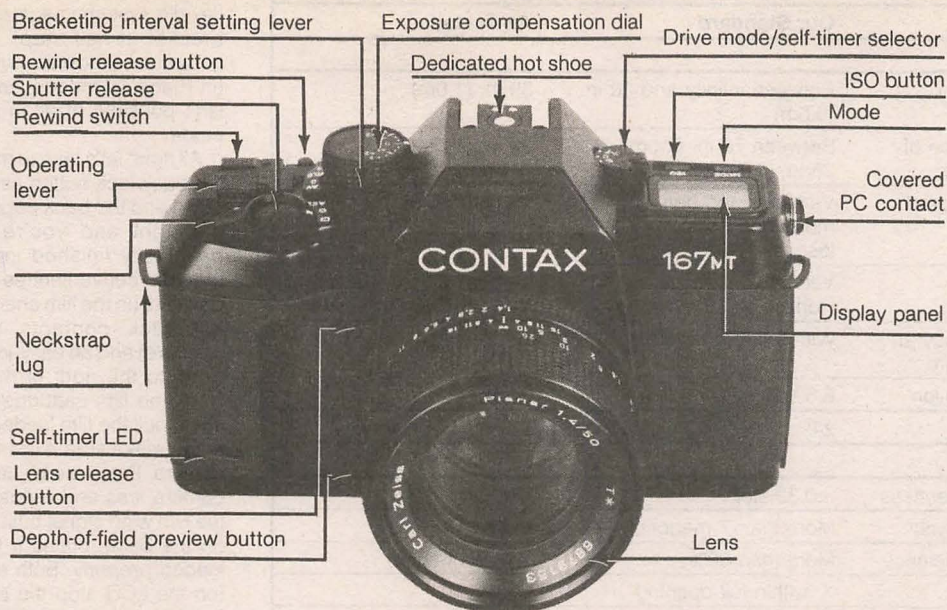
Ever since Yashica (now a division of Kyocera Corp.) began making Contax SLRs in Japan back in the early 70s, they have been remarkably successful in living up to the proud Zeiss heritage behind the Contax name. With input from European designers, Contaxes were among the first to employ soft, rubberized body coverings for superior comfort and grip, and they have always been elegantly proportioned, and extremely pleasant to hold and operate, with their smooth, ergonomically placed controls.

The lenses ordinarily mounted on the Contax's sturdy, chromed steel bayonet mount bear the legendary name of Carl Zeiss (less expensive lenses in Yashica/Contax mount also fit and function in manual aperture priority modes). These lenses are German designs made by Yashica in Japan to Zeiss's exacting specifications.

For the last decade, Contaxes have been developed along two parallel lines—professional models like the RTS and the current RTS II, and what might be termed high tech multimode models for the serious enthusiast. This latter group



## What's New at a Glance: Contax 167 MT



includes such distinctive machines as the original Contax 139 and 137 and the still-current 137MA and 159MM (the first Contax to offer programmed autoexposure via slightly modified MM-mount lenses). The Contax 167MT, the subject of this test, combines most of the outstanding features of these last two models and adds such leading edge items as auto bracketing, three program modes and comprehensive LCD readouts.

To turn on this electronically controlled SLR with built-in motor drive, flick the main switch around the electromagnetic shutter release forward, thereby uncovering a red dot. The instant you do so, the exposure mode in use, plus aperture, shutter speed and frame number are displayed for 16 seconds on the smallish, top-mounted LCD panel, which then turns itself off to conserve power. To turn on the display again, touch the mode or shutter button lightly. The nicely contoured main switch lever has three click-stopped, power on positions for different metering options—center-weighted (denoted by a rectangle), spot (indicated by a small circle) and autoexposure lock (opposite the AEL mark) which locks in spot readings taken in any autoexposure mode. Once you lock in a reading in AEL, its light value is stored in memory, so you can then switch to another aperture or shutter speed without altering the exposure—an excellent feature.

Like many recent SLRs, the 167 doesn't have a conventional shutter-speed dial, film speed dial, or even a mode-selector lever. All functions are controlled by an electronic sliding switch behind the shutter release, which Contax engineers call an operating lever. Hold in the mode button behind the LCD panel (with the LCD on) and change modes by pressing the nicely ridged but smallish operating lever either to the left or right. Press this spring-loaded switch repeatedly until the mode you want is displayed on the LCD. The choice of exposure modes is impressive—TV (time value, that is, shutter-preferred), AV (aperture-preferred), M (metered manual)

and three Program modes, Program High, Normal Program, and Program Low.

Of these six modes there are only two in which you ordinarily select a shutter speed, manual (M) and shutter-preferred (TV). Choose either one and you change shutter speeds by pressing the operating lever *without* holding in the mode button. Press once toward the right and quickly release the switch and your shutter speed will get faster by one full step. Hold the switch toward the right and the shutter-speed numbers on the LCD increase rapidly until they top out at 4000 (that is, 1/4000 second, the 167's top shutter speed). To set slower (longer) shutter speeds, press or hold in the operating lever toward the left. The same procedure applies for manually set film speeds except that you must hold in the little ISO button behind the LCD panel while pressing the operating lever—to the right for higher ISOs. With DX-coded film the camera automatically sets film speeds from ISO 25–5000, which you can check at any time by pressing the ISO button. Manually settable ISOs cover a wider range, from 6–6400.

In aperture-preferred (AV) or manual mode, you set apertures the good old fashioned way, by turning an aperture ring at the rear of the lens barrel; it's click-stopped at full stop intervals. However, the Contax 167 is certainly up to date in reading out apertures (in half-step increments) and shutter speeds in two places at once—on the top-mounted LCD and in the viewfinder above the focusing screen.

In many ways, the thin, white, two section LCD panel atop the viewfinder is one of the camera's nicest features. It lights up whenever you touch the shutter release (irrespective of light level) so its clear black numerals are always visible. It displays the frame number in a separate box, left of the exposure readouts, a Contax first that is still the best of its kind.

The seemingly sparse in-finder LCD also conveys a surprising amount of additional information while remaining

mercifully uncluttered. In metered manual mode a plus or minus flashes at the left of the shutter speed if the exposure is incorrect; simply change the shutter speed and/or aperture until both signs disappear to get the correct metered exposure. Set the exposure compensation dial to a value other than zero and a plus appears if you've dialed in extra exposure, a minus if you've dialed in less. Choose spot meter mode and you'll see a tiny circle in between the shutter-speed and aperture numerals; select AE Lock and the circle flashes in warning. Select any of the three program modes and a P appears at the extreme right.

The over/underexposure warning is equally simple and unmistakable—if the "4000" shutter speed flashes while you're in any autoexposure mode, your shot will be overexposed, if the "16" (16 second) speed flashes, it'll be underexposed. Given the camera's wide metering range, you'll seldom see these warnings. Our only complaint about the 167's in-finder readouts: Some eyeglass wearers won't be able to see the full viewing area and the LCD in a single glance with the rubber-edged eyecup in place. Most will be able to do so with the eyecup removed.

For a camera aimed at advanced photographers, the Contax 167 is equipped with a surprising number of failsafe overrides designed to prevent typical amateur mistakes. For example, if the shutter speed you select in shutter-priority (TV) mode cannot provide the proper exposure at any of the available apertures, the camera will automatically change shutter speeds to provide the correct metered exposure. The altered shutter speed is displayed in the finder, so if you object to the camera taking over you can point it at a subject that gives you the reading you want and lock in the reading with the AE lock, or switch to manual mode. The same philosophy prevails in program and TV modes if you fail to set the lens to the green-coded minimum aperture (as you must to access the full range of



## GENERAL PERFORMANCE

| Checkpoints                            | Our Standard                                                                                                       | As Tested                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>FINDER:</b>                         |                                                                                                                    |                                                    |
| Apparent viewing distance              | Between infinity and 20 in. (0.5m)                                                                                 | 39 in. (1.0m)                                      |
| Apparent distance of information scale | Between 79 in. (2.0m) and 26 in. (0.7m)                                                                            | 39 in. (1.0m)                                      |
| View area compared to film area        | Vertically and horizontally more than 90%, less than 100%                                                          | Vertical: 93%<br>Horizontal: 94%                   |
| Parallax error compared to film        | Vertical: 0.9mm<br>Horizontal: 1.0mm                                                                               | Vertical: 0.2mm (down)<br>Horizontal: 0.2mm (left) |
| Focusing accuracy at maximum aperture  | Within depth of focus                                                                                              | No Discrepancy                                     |
| Image magnification                    | 0.80X±.1x                                                                                                          | 0.83x                                              |
| <b>PICTURE SIZE:</b>                   | 24 ± 0.6mm x 36 ± 0.9mm                                                                                            | 24.3mm x 36.4mm                                    |
| <b>SHUTTER:</b>                        |                                                                                                                    |                                                    |
| Curtain travel evenness                | ±0.33 stop                                                                                                         | -0.1 stop                                          |
| Insulation from sync                   | More than 7 megohms                                                                                                | Infinity                                           |
| Sync contact efficiency                | More than 60%                                                                                                      | 84% (hot shoe)                                     |
| Sync delay time                        | X: within full opening                                                                                             | Okay                                               |
| Shutter curtain bounce                 | Not allowed                                                                                                        | None                                               |
| Self-timer delay                       | 7-15 seconds                                                                                                       | 10 seconds                                         |
| <b>CAMERA NOISE:</b>                   | 73 dB(a), average noise for autofocus SLR                                                                          |                                                    |
| <b>CAMERA SIZE:</b>                    | Body: 5¼ in. wide x 3⅝ in. high x 2¼ in. deep (147 x 86 x 57 mm)<br>Lens: 1½ in. long, 2⅝ in. diameter (41 x 67mm) |                                                    |
| <b>WEIGHT:</b>                         | Body: 1 lb. 10½ oz. (752g) with batteries<br>Lens: 6½ oz. (185g)                                                   |                                                    |

aperture settings). Here the Contax automatically provides the correct exposure using the limited aperture range in between the maximum aperture of the lens and the aperture you've set—a system used by other cameras with similar program modes. There's nothing conceptually wrong with either of these automatic safety systems (the latter can even be used creatively to limit depth of field, for example), but we would prefer that the camera warn you to *reconsider* your shutter speed or aperture selection by flashing the P or the shutter speed in the finder.

Inset into the left-hand side of the prism housing is a cute little three-position switch that's the only control on the 167 that's a tad too small for easy manipulation—the wind mode/self-timer switch. It's got the usual settings found on late-model cameras with built-in winders—S for single-frame advance, C for continuous advance at up to three frames per second, and S-T, for self-timer. Select S-T and press the shutter release and an LED at the bottom of the built-in handgrip flashes—first rapidly, then about once per second, then rapidly again just before the shutter fires ten seconds later. The delay remaining is simultaneously counted down in LCD digits in both frame counters. You can't miss it.

Once the shutter fires, the motor immediately winds to the accompaniment of a distinctively high pitched but low intensity whir. Actual noise is about average, and most of those asked to comment on the 167's unusual sounding "click-wind" sequence said the camera had a "high quality" sound.

Before we get to our field test, let's turn

to the 167's pioneering feature—autobracketing, or as they say at the Contax factory, Automatic Continuous Exposure Compensation. To set autobracket, direct your attention to the green and white scale to the right of the prism housing, just below what must be the most prominent and easiest to set exposure compensation dial extant (it's settable to plus or minus two stops in one-third stop intervals). The white segment of the scale, labeled AV, has clickstopped setting marked 0, 0.5 and 21; the adjacent green segment is labeled P.TV and has stops marked 0, 1, 21.5. Both are simultaneously set by turning the same small ridged tab to the left of the shutter release in a clockwise direction. Which scale applies obviously depends on which autoexposure (AE) mode you've set—the white scale values apply only in aperture-priority (AV) mode, the green ones in program (P) or shutter-priority modes. The numbers themselves refer to the exposure variation (in steps or stops) between the successively bracketed exposures.

To bracket automatically, select your AE mode, set the amount of exposure variation you want on the appropriate scale, and set the wind mode control to C. Now hold in the shutter release and the camera will fire a three-frame sequence (overexposure, correct exposure, and underexposure) and then stop. As soon as you turn on the auto bracket, the left-hand digit of the in-finder frame counter flashes in warning. As the sequence is shot, the exposure counter displays flash both digits then the right digit, then the left to indicate the shooting order. The Contax's autobracketing system works very well and is certainly a welcome addition on a

posh multimode SLR aimed at hard-core enthusiasts. However, it's not the most flexible system imaginable—you can only bracket in half stops in AV mode, the maximum exposure variation is 1.5 stops (in P and TV modes), and autobracketing isn't possible at all in manual exposure mode.

All right, let's take some pictures. Hold in the back lock button as you slide the lock down and the back pops open. Swing it to the right and you're greeted with a beautifully finished interior with all the modern conveniences—gold-plated DX contacts (in the film chamber), gold-plated databack contacts (below the film aperture) and an easy-loading film take-up drum to the right of the sprocket shaft. Hook the film cartridge under the rewind shaft, pull the film leader out to the orange mark (make sure it lies flat) and close the camera. Press the shutter release and the camera fires and winds three times while the film wind signal built into the thumbrest on the back rotates if the film has been loaded properly. Both exposure counters (on the LCD atop the camera and in the finder) now read "01." Now hold in the mode button, and press the operating lever until the word "Program" appears on the LCD. Make sure the lens is set to minimum aperture (green digits).

In the 167's normal program mode, shutter speeds get faster and apertures get smaller in equal amounts as the light level increases, starting at 1/15 second with 50mm f/1.4 lens at ISO 100. Select the low-speed program (Program Low) and the program provides smaller apertures and slower shutter speeds to maximize depth-of-field at light levels above EV6. Select the high-speed program (Program High) and the lens remains wide open until the proper-exposure shutter speed reaches 1/250 second. In other words, this program is biased to provide action-stopping shutter speeds when possible.

Once you match the program to your shooting conditions you can concentrate on your subject and enjoy one of the 167's most commendable features, its bright, very contrasty focusing screen. In its center is a tiny split-image rangefinder surrounded by a small micropism collar. The outer perimeter of the collar accurately defines the spot metering area, and both focusing aids are surprisingly effective and easy to use despite their minuscule size. We also liked the focusing action of the 50mm f/1.4 Planar—it's very smooth and well damped—and its focusing and aperture-ring collars, which are wide, well placed and very grippable. Two small complaints: 1. The depth-of-field preview button requires such a hard push it dents your index finger. 2. A small, fiddly coin slotted cover lock mars an otherwise well resigned four-AAA battery compartment built into the bottom of the body.

The Contax 167's through-the-lens (TTL) flash system is as sophisticated as its exposure and readout systems. Mount a dedicated Contax flash unit (such as the TLA 20 or TLA 30) in the three-contact dedicated hot shoe and you have the options of programmed autoflash and auto daylight fill flash in program modes, the equivalent of Program TTL autoflash in shutter-preferred mode, a full choice of



apertures in aperture-priority TTL mode, and semi-automatic control of the subject-to-background flash ratio by using the AE lock or exposure compensation dial. As soon as the dedicated flash is fully charged, the shutter is automatically set to the flash sync speed of 1/125 second and a lightning bolt comes on in the finder display. After the flash has fired, the lightning bolt blinks for about two seconds to confirm correct exposure. If the "125" blinks in the finder, select a smaller aperture or your picture will be overexposed—a useful type of warning not found on many other SLRs.

The 167 continues the Contax tradition of excellent handling and fine balance. Indeed, we found it to be even more comfortable than most of its predecessors, which were widely admired for their luxurious feel and convenient contours. (Only the RTS II equals and possibly surpasses the 167 in these respects.) Its controls are all sensibly placed and easy to memorize so that operating the camera at eye level (with an occasional glance at the main LCD when changing modes) becomes fluid and natural after shooting a couple of rolls. As you can see by glancing at the performance charts, the Contax provides high performance in all measurable categories. What is perhaps more important in this age of rampant me-tooism, it also offers refinement, distinction, and a touch of class for those who can appreciate and afford it.

## Zeiss 50mm f/1.4

### PERFORMANCE

| Our Standard                                                                      | As Tested      |
|-----------------------------------------------------------------------------------|----------------|
| <b>Focal length:</b> ±5%<br>(47.50-52.50mm)                                       | 51.55mm        |
| <b>Aperture:</b> ±5%<br>(f/1.33-1.47)                                             | f/1.44         |
| <b>Distortion:</b><br>(±1.5%)                                                     | 0.92% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.6 stops      |

### RESOLUTION

#### ZEISS PLANAR 50mm f/1.4 at 1:51

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 1.4 | Good          | 45 Excellent  |
| 2   | Good          | 51 Excellent  |
| 2.8 | Good          | 57 V. Good    |
| 4   | V. Good       | 64 Excellent  |
| 5.6 | Excellent     | 72 Excellent  |
| 8   | Excellent     | 72 Excellent  |
| 11  | Excellent     | 64 Excellent  |
| 16  | V. Good       | 57 Excellent  |

### CONTRAST

#### at 30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 1.4 | High       | 52 High    |
| 2   | High       | 54 High    |
| 2.8 | Medium     | 56 High    |
| 4   | High       | 61 High    |
| 5.6 | High       | 72 High    |
| 8   | High       | 68 High    |
| 11  | High       | 54 High    |
| 16  | Medium     | 41 Low     |

## CONTAX RTS II, LOOKS THE SAME, BUT . . .

**MANUFACTURERS SPECIFICATIONS:** Contax RTS II Quartz 35mm single-lens-reflex camera. Body No. 146062. **LENS:** 50mm f/1.4 Zeiss Planar in Contax/Yashica bayonet mount, No. 6425055, with stops to f/16, focusing to 1 ft. 6 in. (0.45 m), accepts 59mm screw-in accessories. **SHUTTER:** Quartz-timed, electronically operated, horizontal-travel titanium focal-plane with speeds from 16 to 1/2000 sec. in auto mode, 4 to 1/2000 sec. in manual mode, plus B, X sync., 1/50 sec. mechanical and B without battery, electronic self-timer. **VIEWING:** Non-interchangeable eye-level prism with interchangeable focusing screen having central micropism, fine focusing collar. **METERING:** Single silver-oxide battery-powered silicon-photodiode circuit with cell above viewfinder eyepiece measures center-weighted area of entire focusing screen at full aperture and second SPD inside mirror box which measures exposure off the film with dedicated flash units. Aperture-priority auto exposure with auto-compensation dial and compensation warning in viewfinder, exposure memory holds EV. **OTHER FEATURES:** Removable back with memo holder, depth-of-field preview, mirror lock-up, hot sync shoe with provision for electronic remote and cable release, special flash unit coupling, auto winder, motor drive and data back. **MANUFACTURER:** Yashica Co. Ltd., Okaya, Japan. **IMPORTER:** Yashica Inc., Paramus, NJ 07652. **Price:** \$1016 with 50mm f/1.4 Zeiss Planar. Body only, \$750.00.

## 35MM Single Lens Reflex

It's been over seven years since we tested the Contax RTS, but it has taken that long for many of the other manufacturers to catch up with some of the Contax innovations. Contax was among the first to put LEDs in finder, and to make full use of the camera's electronic circuitry with such now common features as electromagnetic shutter and remote release on a 35mm SLR, and complete viewfinder information including auto-compensation warning. Over those six long years we have seen the introduction of several cameras to the Contax line, incorporating such innovations as electronic quartz timing, and off-the-film flash metering, as Yashica, like all camera manufacturers struggled to keep the Contax "state-of-the-art" in electronics. These were exciting, useful additions to Contax photography, but unfortunately kept to the newer compact models 139 and 137 MD, never to be added to the more rugged top-of-the-line Contax RTS—until now.

Borrowing features and technology from all previous models, while adding major new ones, the Contax engineers have unveiled a professional-level SLR claimed to be extraordinarily rugged and durable, but packed with electronics as well as some surprising mechanical backups, which we'll discuss as we put the camera through the paces.

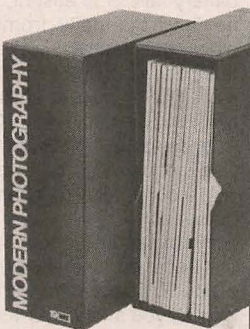
At first glance, the RTS II is hard to distinguish from its predecessor. In appearance, the major differences are in the styling of the electronic self-timer, (as opposed to the mechanical lever on the RTS), and the location of the PC contact, which has been raised to the top of the body of the Contax RTS II. Viewing the camera from the top reveals even more subtle differences: the addition of flash dedication, a shutter-speed dial lock, an on/off switch added below the ASA setting dial, two slight protrusions from the camera's back indicative of an eyepiece blind lever, and the absence of the battery check display.

The bottom of the camera is conventional with rewind button and battery cover, plus provision for motor drives. The cover is a big improvement over all similar battery covers. No longer need you fumble through your pockets for an appropriate coin to open the battery compartment. Instead a hinged key sits flush within the recessed cover. Even clumsy fingers should have little difficulty in lifting up this key then turning it to unscrew the cover. In the compartment goes either a 6.2-volt silver-oxide (Eveready 544 or equivalent) or a 6-volt alkaline-manganese battery (4LR44). As with most electronic cameras, the camera circuitry must be turned on before film can be loaded. To turn the camera on, flip the lever located just below, and to the front of the ASA setting dial to the left. A red dot beneath the lever indicates that the camera is operational. To check the batteries, press the meter-check button on the front, with your right index finger. The viewfinder LEDs light if the battery is O.K. If the LEDs light, but flash rapidly, then the batteries are weak, and should be replaced as soon as possible. Leaving the camera on for extended periods shouldn't drain the battery, as the finder LEDs will go off 16 secs. after releasing the meter-check button. The battery will drain slowly, (rapidly if the exposure lock is engaged, or meter-check button remains inadvertently pressed), so we suggest that the camera be turned off whenever it won't be used for more than an hour.

Pull up on the rewind knob to open the

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## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                | As Tested                                        |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                             |                                                  |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                          | 39in (1.0m)                                      |
| Apparent distance of shutter-speed scale | Between 79in (2.0m) and 26in (0.7m)                                                                         | 31in (0.8m)                                      |
| Apparent distance of aperture scale      | Same as above                                                                                               | 52in (1.3m)                                      |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                   | Vertical: 97%<br>Horizontal: 97%                 |
| Parallax error compared to film          | Vertical: 0.37mm<br>Horizontal: 0.55mm                                                                      | Vertical: 0.1mm (up)<br>Horizontal: 0.1mm (left) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                       | no discrepancy                                   |
| Image magnification                      | 0.87X $\pm$ 0.1X                                                                                            | 0.85X                                            |
| <b>PICTURE SIZE:</b>                     | 24 $\pm$ 0.6mm<br>36 $\pm$ 0.9mm                                                                            | 24.4 x 36.4mm                                    |
| <b>SHUTTER:</b>                          |                                                                                                             |                                                  |
| Curtain travel evenness                  | $\pm$ 0.33 stop                                                                                             | 0.20 stops                                       |
| Camera insulation from sync              | More than 7 megohms                                                                                         | Infinity                                         |
| Sync contact efficiency                  | More than 60%                                                                                               | (PC/contact) 90%                                 |
| Synchronizer delay time                  | X:within full opening                                                                                       | Okay                                             |
| Shutter curtain bounce                   | Not allowed                                                                                                 | none                                             |
| Self-timer delay time                    | 7-15 sec.                                                                                                   | 10 sec                                           |
| <b>CAMERA SIZE:</b>                      | Body: 3½ in. high, 5¼ in wide; 2½ in deep (90×144×54mm)<br>Lens: 2¼ in. dia. $\times$ 1½ in. deep (62×40mm) |                                                  |
| <b>WEIGHT:</b>                           | Body: 1lb. 10½oz. (740g) w/battery<br>Lens: 9½oz. (271g)                                                    |                                                  |

camera back. The film is loaded in the conventional manner. With the camera set to "auto" the shutter will fire at 1/60 sec. to prevent inadvertent delays in getting the camera operational as you advance the film to frame 1. As with the original RTS, you can't watch the rewind crank turn when advancing film, to check film advance. Instead, a white bar turns counterclockwise in the center of the rewind crank if all is well. The rapid wind lever remains virtually unchanged from the RTS, using a single 140° or multiple stroke. Any ASA from 12 to 3200 can be set by lifting the ASA setting collar to the right of the prism and turning it until the white line aligns with the required ASA. (For those planning to use Kodacolor 1000, the first dot after 800 is ASA 1000). Make sure that the auto-compensation setting below this collar is at X1. There is no locking device, only detents, to keep the collar from shifting accidentally. However, if the auto-compensation isn't at "X1", a warning will appear in the viewfinder.

Set the shutter-speed dial around the rewind knob to "A" and the RTS II is ready for action. If the dial doesn't turn, it's because a pushbutton lock has been added on the back of the camera, just to the lower right of the dial. The lock only works on two settings, A, for aperture-preferred automatic exposure, and X, for manually-set sync speed. This is a welcome feature as we often found the earlier Contax accidentally shifted settings.

The viewfinder is one of the brightest on

any SLR with the whole picture area almost entirely visible, even by eyeglass wearers. An accessory rubber eyecup is furnished and correction eyepieces are available. As with most SLRs, we found the rubber eyecup difficult to use with glasses. The center of the standard focusing screen has a microprism to assure focus. To see the finder information, touch the exposure check button on the front, right of the camera. You needn't hold the button, as the display will remain on for 16 secs. after you let go. Pressing the shutter release slightly will also turn on the finder information, but only when the shutter is not wound, (if wound, and you try this the shutter will release!)

To the right of the screen you'll see bright red LED-lit shutter-speed numerals. At the bottom, you see segmented LEDs (the type you'll find on many calculators and in the Canon A-1) indicating the aperture set to the nearest ½ stop. If two speeds are lit, then the actual shutter speed will be about half-way between. Changing the shutter-speed selection to manual does not remove this information from the display, instead, the manually selected shutter speed will flash, while the camera-selected shutter speed remains constant. If the two speeds coincide, only one number will flash in the finder. Once you get used to this system you'll find the RTS II easy to use manually. (If there is no film in the camera, or the film is not wound to the first frame, the display reads as if you had man-

ually selected the 1/60 sec. shutter speed).

On "A" you can hold any exposure setting by pushing upward on the memory hold lever adjacent to the exposure check button. A white line on the lever indicates its position clearly. The exposure selected remains constant no matter how many exposures are made. To return to regular operation, push the lever down. The lever can be operated, even while you're looking through the finder. Within, the shutter speeds flash to warn you that the memory hold is in use.

The memory hold does have a unique feature: if the memory hold is on and the aperture is changed, the corresponding shutter speed will automatically shift to maintain the same exposure (EV) level. The finder display shifts appropriately, showing the different f/ stop and shutter-speed combinations.

Besides using the memory hold, the auto-exposure setting can also be altered by using the  $\pm$  2 stop auto-compensation dial concentric with the ASA dial. It can be set in ½ stop increments. Within the finder, + or - indicator LEDs light to the right of the aperture LEDs, a useful feature. It would have been better if the amount of compensation also appeared, but such information isn't available on any cameras, yet. Auto compensation will work up to  $\pm$  2 stops at both ASA 3200 and ASA 12.

The camera's controls fall almost automatically under your fingertips. Clearly ergonomic features are still important to the design team and continuing the basic Porsche design concepts seen in the original RTS. Gently press the electromagnetic shutter to release the quartz-timed, rubberized titanium focal-plane shutter. The shutter has curtains of reduced thickness, only 0.015 mm, about half as thick as standard shutter curtains.

The Contax RTS II makes extensive use of ball bearings to reduce friction and assure mechanical reliability. Ball bearings are used in six points of the shutter mechanism. If the battery fails or is absent, the shutter can still be fired manually from a rather unlikely place, the depth-of-field preview plunger at the bottom of the lens mount. Normally a white line on a lever adjacent to this plunger points upwards. Flip this lever outwards, 90° from the body. Now the depth-of-field preview becomes a non-electric release to provide a completely mechanical 1/50 sec. shutter speed.

For exposures longer than 16 sec. on auto, or 4 secs. on manual, turn the shutter-speed dial to B. The shutter will remain open for as long as you maintain pressure on the shutter release. You can also use a standard or electronic cable release in the socket at the back of the camera, just below the wind lever. However, prolonged exposures made in this manner can drain the battery. To obviate this problem for making such pictures as an all-night exposure of the stars, there's a second cable release socket on the bottom of the lens mount. This allows you to operate the shutter mechanically on B, with no battery drain at all.

Above this socket you'll find a mirror lock-up lever, a feature sadly missing on many other "top-of-the-line" models. It's extremely useful in avoiding camera vibration when doing such work as photomicrography.

As with the earlier RTS, focusing screens are changeable from the mirror box with a special tool. Although RTS II screens are not interchangeable with those for the RTS, to accommodate the RTS II's brighter, larger



focusing screen, most screen types available for the original have been duplicated for the model II.

Many users consider off-the-film (OTF) flash metering as almost a necessity in a top-of-the-line SLR. Borrowing the system originally introduced in the Contax 139, and later used in the 137MD, the RTS II designers installed an SPD cell in the bottom of the mirror box facing the film to monitor and control flash exposure right from the film surface. Coupled with the TLA20, TLA30, or the larger grip-type RTF540 (with optional "TLA" adapter), the RTS II will provide viewfinder flash ready, and flash confirmation signals. With the flash recycled and ready to fire, the shutter speed is automatically set to 1/60 sec. Independent "dedicated" units offering TTL flash metering for the 137 and 139 should work as well on the RTS II.

In cold weather when batteries become less efficient, or cease operating altogether, or a backup power supply is needed, the External Power Pack P-3 can replace the camera's battery. The P-3 incorporates four 1.5v AA cells, (Niacads can't be used), and connects to the camera via a silicon-coated cord. The batteries fit into a pouch which you can slip into your pocket. You can quickly disconnect the P-3 when required.

The RTS was one of the earliest cameras to feature a data back as an off-the-shelf accessory, but that back had to be coupled to the camera via the PC socket. The RTS II triggers the data back directly by lighting a small LED in the bottom of the film chamber. The Databack Quartz D-4 can imprint the date, time, a predetermined index, or can be set to imprint a count from 000 to 399 in the lower right corner of the frame. For Databack users, Contax has a very clever special focusing screen which shows the data imprinting location in the finder.

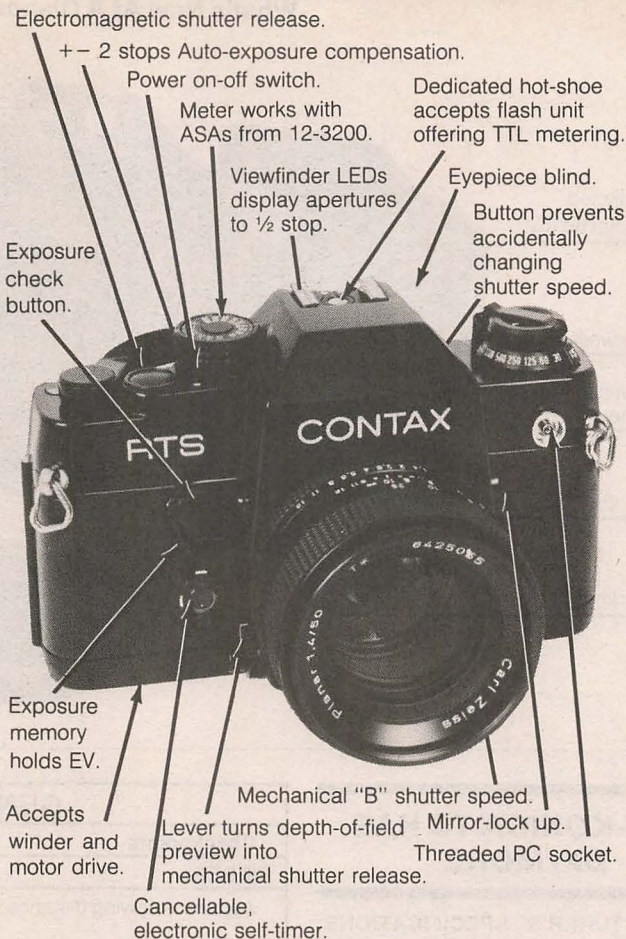
While the RTS motor drive and autowinder will work with the RTS II, on continuous setting only, the Real Time winder W-3 (\$178), and Professional Motor Drive unit W-6 (\$705 with power pack) are designed specifically for the RTS II, but should work equally well with the RTS. Both the W-3 and W-6 offer single frame as well as continuous firing capability. We found the winder capable of frame rates up to 2.8 frames/sec., the motor drive up to 4.8 fps. Six AA cells power the winder which is usable at all shutter speeds in either manual or auto-exposure modes.

The motor drive W-6 incorporates an intervalometer which can be set at selected speeds from 3 fps to 1 frame every 60 seconds (see photo below right). You can set a countdown frame counter, so that the motor will stop after any number of exposures. The battery pack powering the motor drive holds 12 AA cells. It attaches below the motor drive, sporting a power level meter instead of the more common battery check.

Weighing the same as the Canon F-1, at 2 lbs. 5½ oz. (each with lens), the RTS II is a tad heavier than most current SLRs, but many of us felt that its solid feel is a valuable asset. It took us a few minutes to adjust to the unconventional placing of the shutter-speed dial. As with the RTS, once we accepted this control location, we judged changing speeds as easy as on any SLR to date. At first we were curious about the lack of a split-image focusing aid on the standard focusing screen, but we found the bright central micro-prism focusing fast and accurate.

Aside from the aforementioned possibility

## What's New At A Glance: Contax RTS II Quartz



of excessive battery consumption under certain conditions, it is difficult to seriously find fault with the RTS II. Most of our comments run in the "what could have been" category. After using the Contax 137 MD and getting hooked on the in-finder frame counter, we would have been delighted if Contax had borrowed this (so far) exclusive feature and incorporated it in the RTS II. After trying auto-exposure compensation in the field, we decided that the location of the auto-compensation dial would enable quick bracketing without removing your eye from the finder if there was a simple way of switching the functions of the meter check and shutter release buttons.

Like all Contaxes, the RTS II uses Zeiss lenses, and will accept any other lens in the Contax/Yashica bayonet mount. As we did with the RTS, we tested our sample with its high-speed normal lens, a 50mm f/1.4 Zeiss Planar T\*.

**Field test slides:** We found the flare to be very well controlled even when shooting directly towards the sun. We found our slides crisp and snappy, although there appeared to be a slight softness at the wider apertures. This performance is considered average for a 50mm f/1.4 lens.

**Optical bench analysis** (for optical experts only): On axis we observed a slight overcorrected spherical aberration and a slight zonal aberration in a very compact image. Both aberrations were gone by f/2.8. Off-axis we observed slight skew-ray flare, very slight astigmatism, and a very, very slight coma pattern, all of which were gone by f/5.6. (February 1983)

### PERFORMANCE

| Our Standard                                                                      | Tested    |
|-----------------------------------------------------------------------------------|-----------|
| <b>Focal length:</b> 5%<br>(47.5052.50)                                           | 50.76mm   |
| <b>Aperture:</b> 5%<br>(f/1.33/f/1.47)                                            | f/1.41    |
| <b>Distortion:</b> (1.5%) 1% (barrel)                                             |           |
| <b>Light falloff:</b> at f/5.6,<br>1 stop from theoretical limit<br>(0-1.3 stops) | 0.3 stops |

### RESOLUTION

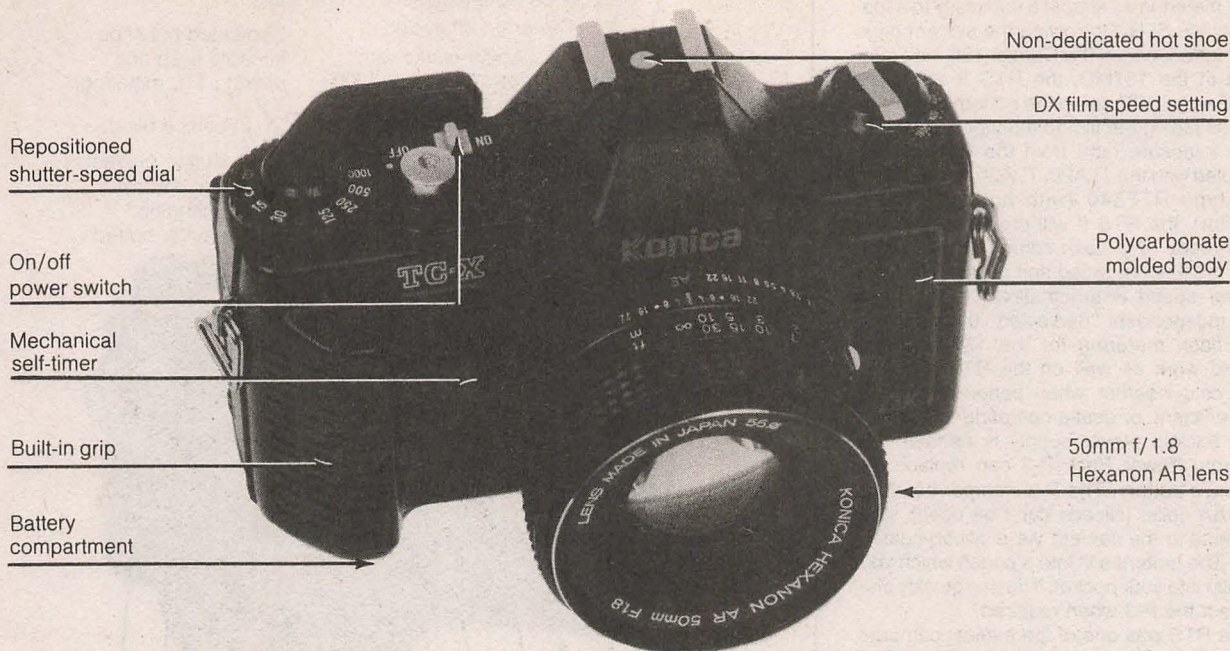
| PlanarT* 50mm f/1.4<br>at 1:48 Magnification |                      |    |                      |    |
|----------------------------------------------|----------------------|----|----------------------|----|
| f/no.                                        | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 1.4                                          | Accept               | 43 | V. Good              | 34 |
| 2                                            | Good                 | 54 | Good                 | 38 |
| 2.8                                          | Accept               | 54 | Good                 | 43 |
| 4                                            | Good                 | 61 | Good                 | 48 |
| 5.6                                          | Good                 | 61 | V. Good              | 54 |
| 8                                            | Good                 | 61 | Excellent            | 61 |
| 11                                           | V. Good              | 61 | Excellent            | 54 |
| 16                                           | Good                 | 54 | V. Good              | 48 |

### CONTRAST

| PlanarT* 50mm f/1.4<br>at 30 lines/mm |            |    |            |    |
|---------------------------------------|------------|----|------------|----|
| f/no.                                 | Center (%) |    | Corner (%) |    |
| 1.4                                   | Low        | 34 | Low        | 22 |
| 2                                     | Medium     | 51 | Low        | 24 |
| 2.8                                   | Medium     | 55 | Medium     | 43 |
| 4                                     | Medium     | 56 | High       | 56 |
| 5.6                                   | Medium     | 57 | High       | 56 |
| 8                                     | Medium     | 52 | High       | 56 |
| 11                                    | Medium     | 48 | High       | 47 |
| 16                                    | Medium     | 41 | High       | 40 |



## What's New At A Glance: Konica TC-X



## NEW KONICA TC HAS DX, MORE

**MANUFACTURER'S SPECIFICATIONS:** Konica TC-X single-lens reflex, Body No. 139838. **LENS:** 50mm f/1.8 Konica Hexanon AR interchangeable bayonet mount #710574, focus to 18 in., accepts 55mm threaded accessories. **SHUTTER:** Mechanically-controlled Copal focal-plane with speeds from 1/8 sec. to 1/1000 sec. and B. X-sync to 1/60 sec., mechanical self-timer. **EXPOSURE SYSTEM:** CdS cell atop pentaprism reads centerweighted area of focusing screen; ISO/ASA 50-1600. Shutter-preferred auto-exposure with metered manual mode. **VIEWFINDER:** Non-interchangeable eye-level prism with central split-image rangefinder, microprism collar, matte outer area. Needle indicates correct-exposure of apertures from f/1.4 to f/22, over-and-under-exposure warnings; red manual operation indicator. **OTHER FEATURES:** DX automatic film speed setting with manual override. Operational at all shutter speeds without battery power. Polycarbonate chasis with built-in grip. Non-dedicated hot-shoe. **BATTERIES:** One AAA alkaline. **PRICE:** \$159.50 body only; \$258.50 with 50mm f/1.8 Konica Hexanon AR lens; \$339.50 with 50mm f/1.4 Konica Hexanon AR lens. Back in August, 1976, Konica introduced the TC, one of the first entry level shutter speed-preferred auto-exposure SLR's. A compact, budget priced camera with abbreviated slow shutter speeds (1/8 - 1/1000 sec.), it featured a die-cast metal chassis, mechanically-controlled auto exposure plus full manual control. It sold steadily until production was officially discontinued over 7 years later in December 1983. By contemporary photo industry standards that's an incredibly long

## GENERAL PERFORMANCE

| Checkpoints                           | Our Standard                                              | As Tested                                                                                                         |
|---------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>FINDER:</b>                        |                                                           |                                                                                                                   |
| Apparent viewing distance             | Between infinity and 20 in. (0.1m)                        | 31 in. (0.8m)                                                                                                     |
| Apparent distance of aperture scale   | Between 157 in (4.0m) and 31 in (0.8m)                    | 66 in. (1.7m)                                                                                                     |
| View area compared to film area       | Vertically and horizontally more than 90%, less than 100% | Vertical: 93%<br>Horizontal: 94%                                                                                  |
| Parallax error compared to film       | Vertical: 0.8mm<br>Horizontal: 1.1mm                      | Vertical: 0.2mm (up)<br>Horizontal: 0.05mm (right)                                                                |
| Focusing accuracy at maximum aperture | Within depth of focus                                     | No Discrepancy                                                                                                    |
| Image magnification                   | 0.87X ± .1X                                               | 0.87X                                                                                                             |
| <b>PICTURE SIZE:</b>                  |                                                           | 24.2mm x 36.1mm                                                                                                   |
| <b>SHUTTER:</b>                       |                                                           |                                                                                                                   |
| Curtain travel evenness               | ±0.33 stop                                                | -0.23 stop                                                                                                        |
| Insulation from sync                  | More than 7 megohms                                       | Infinity                                                                                                          |
| Sync contact efficiency               | More than 60%                                             | 84% (hot shoe)                                                                                                    |
| Sync delay time                       | X: within full opening                                    | Okay                                                                                                              |
| Shutter curtain bounce                | Not allowed                                               | None                                                                                                              |
| Self-timer delay                      | 7-15 sec.                                                 | 10 seconds                                                                                                        |
| <b>CAMERA SIZE:</b>                   |                                                           | Body: 5¼ in. wide × 3⅝ in. high × 1¾ in. deep (133 x 87 x 45mm)<br>Lens: 1⅝ in. long, 2⅞ in. diameter (34 × 62mm) |
| <b>WEIGHT:</b>                        |                                                           | Body: 13⅝ oz. (388g) with batteries<br>Lens: 6⅞ oz. (175g)                                                        |

lifetime for a camera design, and a clear indication that much was right with the original TC.

While the TC's sales perked right along, Konica ventured forth into the high tech world of polycarbonate-clad SLR's with and without built-in motor drives, and has continued to

develop a wide range of autofocus and point-and-shoot leaf shutter 35's. Now, they have finally turned their attention back to the widely imitated TC concept and the result is the TC-X, basically an updated TC that uses a molded polycarbonate chassis and includes a DX automatic film-speed-setting system.



The TC-X is also noticeably smaller and much lighter than the mostly metal TC—13.2 oz. instead of 26 oz. Nevertheless, the TC-X is a classic example of "The more things change, the more they remain the same," for beneath its sleek and stylish exterior lurks a mechanism that has its roots in the Konica Autoreflex of 1967—a mechanical, shutter-preferred automatic with manually settable f/stops and shutter speeds.

Take the TC-X in hand and you will notice several new features immediately. Its surface is now smooth, matte polycarbonate instead of the TC's traditional leatherlike covering. There is a comfortable built-in grip which, when you turn the camera over, reveals a compartment for a single AAA battery, which powers the DX and metering systems.

The controls on the TC-X are conventionally arranged. The only controls on the front are a mechanical self-timer lever settable for a 10 sec. delay, and a lens release button. On top, the knurled shutter-speed dial is located under the non-ratcheted film wind lever. The selection of shutter speeds is, as in the TC, abbreviated at the slow end, ranging from 1/8 to 1/1000 sec. and B. The X-sync speed has also been reduced from 1/125 to 1/60 sec. A questionable change is the removal of the PC receptacle—you now have to rely solely on the non-dedicated hot shoe. A simple on-off power switch is conveniently located behind the large shutter release button. The ISO/ASA dial has been moved to the left side. This manual control overrides the DX system, letting you alter film speed ratings or set film speeds for non-DX cartridges. However, Kodachrome 25 lovers and other slow film users are left out in the cold—neither DX nor manual film speed setting will help you get below ISO/ASA 50.

The frame counter is small but legible, and is located at the back of and below the film wind lever. A film verification window is built into the hinged back. The only metal part, a judicious choice, is the tripod socket plate which is attached by screws to the polycarbonate baseplate. Users can confidently attach the TC-X to tripods without fear of damage to its inner workings—overly long screws simply can't be screwed in past a certain point.

When you open the camera back in the usual pull-up-the-rewind-crank fashion, you'll notice two important new features: all visible main body parts inside the camera are polycarbonate, and in the film-loading chamber there's a row of six DX contact pins. These pins "read" the code off DX-coded cartridges and automatically key the film speed into the camera's exposure system. Loading is conventional, with a convenient multi-slotted take-up spool. The metal-bladed Copal shutter, which travels vertically, looks nearly identical to the one in the original TC.

Before we start shooting, let's take a look at the Konica's Hexanon 50mm f/1.8 lens. The awkward two-handed mount lock release of the TC has been replaced with a simpler one at the base of the lens mount. Press the tab with your middle finger and turn in one smooth 45° counterclockwise motion to remove the lens. The bayonet mount will accept all Konica's Hexanon lenses and independently-made optics in Konica mount. The 50mm f/1.8, the standard lens, is compact and easy to use with its knurled focusing and aperture rings although there is no lock to prevent you from moving the aperture ring

past f/22 to the AE (auto-exposure) setting. However, once in AE, the ring won't turn back until you've pressed a tab on the left side of the aperture ring. To mount the lens, place red dots together and rotate the lens clockwise 70° until it locks.

The TC-X employs Konica's classic mechanical shutter-preferred metering system. To use it, set the shutter speed, set the lens to AE and the camera chooses the proper-exposure aperture for the lighting conditions. The camera-selected aperture is read out by an analog needle and vertical aperture scale on the left side of the viewfinder. If there is too much or too little light, the needle will go off the scale into the zone above or below the numerals. If this happens, rotate the shutter-speed dial until the needle moves back into the aperture number area. The widest aperture of the lens mounted on the camera is indicated by a triangular marker which moves into place atop the f/stop scale. If the needle reaches this marker, you've got to select a slower shutter speed to get it into the "useable aperture" zone. If the needle fails to respond at all when there is enough light to shoot, you're out of battery power—there's no separate battery check button.

Fortunately, even if you are out of juice, the camera remains fully functional (but meterless). To use the TC-X sans battery power, turn on the power switch (it doubles as a shutter lock) and turn the lens aperture ring to any setting other than AE. Consult your local hand-held meter or exposure guide, and set the shutter speed manually. In this day and age of digital and pushbutton entry level cameras that take control out of the user's hands, the Konica's full manual, mechanical backup is a rarity in its class. Among its many virtues: It familiarizes beginners with the basic photographic concepts of aperture and shutter speeds in a "hands on" practical way.

Of course you don't need a dead battery to operate the TC-X manually. You can override the AE simply by turning your aperture ring off the AE setting to any manual f/stop. Turn your shutter-speed dial to the speed you want and the needle still will point the proper-exposure f/stop—set the lens to that f/stop and you have just set a "metered manual" exposure. Of course you're free to ignore the camera's recommendation and set any f/stop.

The TC-X's focusing screen has a central split-image rangefinder surrounded by a useably broad micropism collar. The view through the finder is clear, and the screen is of average brightness, with good image contrast. However, once you complete the pleasant task of focusing and press the release, you'll discover that the TC-X's shutter is definitely on the loud side and makes a clattering sound at most shutter speeds. If you're taking pictures where noise doesn't matter, that's fine. But if you intend to photograph concert pianists or sleeping babies a quieter camera would be preferable.

Fortunately the TC-X's virtues far outweigh its niggling faults. It handles very well indeed. We found the wind lever operated smoothly, as did the rewind crank, although setting the shutter-speed dial can be a bit fiddly as it's positioned underneath the wind lever. With a little practice, however, everything "falls readily to hand." The entire focusing screen is visible to eyeglass wearers, as are all in-finder readouts. The shutter release button requires a moderately heavy touch, but is smooth and consistent in operation. The

## 35MM Single Lens Reflex

light, well balanced body and the built-in grip allowed us to hold the camera securely. The result: shakefree pictures at slow handholdable speeds of 1/30 and even 1/15 sec.

To sum up, although the TC-X breaks no new ground with any single feature, its combination of non-metal body, DX code reading capabilities, and classic manual controls and metering system make it an ideal "back to basics" model for beginning amateurs who intend to learn more about photography. The TC-X marries contemporary styling, design and materials with traditional controls, giving both purists and novices a measure of satisfaction.

Of course in choosing a rather inexpensive entry level SLR one of the things you give up is a system. The TC-X accepts neither a winder nor a dedicated flash, and the body lacks a depth-of-field preview control. However, when you figure how much you do get for the money, the TC-X is impressive. If you're a beginner or simply need an inexpensive Konica body, the TC-X is certainly worthy of consideration. (September 1985)

## 50mm f/1.8 KONICA HEXANON AR

**Specifications:** 50mm f/1.8 Konica Hexanon AR, No. 710574; Konica mount, takes 55mm threaded filters. Apertures from f/1.8 to f/22. Closest focus .55M (1 ft., 9 in.). Depth-of-field scale is calibrated at f/4, 8, 16, 22; infrared focusing index.

### PERFORMANCE

| Our Standard                                                                       | as Tested |
|------------------------------------------------------------------------------------|-----------|
| <b>Focal length:</b> ±5%<br>(47.50-52.50mm)                                        | 52.16mm   |
| <b>Aperture:</b> ±5%<br>(f/1.71-1.89)                                              | f/1.89    |
| <b>Distortion:</b><br>(±1.5%)                                                      | under 1%  |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>(0-1.5 stops) | 0.8 stops |

### RESOLUTION

| HEXANON 50mm f/1.8<br>at 1:51 |                  |    |                  |    |
|-------------------------------|------------------|----|------------------|----|
| f/                            | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 1.8                           | V. Good          | 51 | Excellent        | 45 |
| 2.8                           | V. Good          | 57 | Excellent        | 51 |
| 4                             | V. Good          | 64 | Excellent        | 57 |
| 5.6                           | V. Good          | 64 | Excellent        | 57 |
| 8                             | V. Good          | 64 | Excellent        | 57 |
| 11                            | V. Good          | 57 | Excellent        | 51 |
| 16                            | V. Good          | 57 | Excellent        | 51 |
| 22                            | Good             | 51 | V. Good          | 45 |

### CONTRAST

| HEXANON 50mm f/1.8<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------|---------------|----|---------------|----|
| f/                                   | Center<br>(%) |    | Corner<br>(%) |    |
| 1.8                                  | Medium        | 40 | Medium        | 29 |
| 2.8                                  | Medium        | 48 | Medium        | 31 |
| 4                                    | Medium        | 54 | Medium        | 36 |
| 5.6                                  | High          | 62 | High          | 48 |
| 8                                    | High          | 63 | High          | 49 |
| 11                                   | High          | 59 | High          | 44 |
| 16                                   | Medium        | 48 | Medium        | 35 |
| 22                                   | Low           | 39 | Low           | 29 |



## 35MM Single Lens Reflex

**Practical Comments:** Fairly compact for its speed; very good satin black finish;  $\frac{3}{8}$ -in.-diamond knurled focusing ring turns 180° clockwise from infinity to minimum distance. Straight knurled aperture ring, whole stop detents. Aperture, meter and depth-of-field scales in white, footage scales in gold; AE indicator in green, focus index and infrared index in red.

**Field test slides:** Our Kodachrome 64 slides were generally crisp and snappy. Center images were slightly soft wide open, but improved by f/4. Corner equalled center sharpness by f/4. Slight light falloff was noticeable wide open but gone by f/2.8. Flare was well-controlled throughout. Performance overall was average for a normal focal length lens of this speed.

**Optical bench analysis** (for optical experts only): On axis, we saw very slightly under-corrected spherical aberration. Very slight red flare was gone by f/5.6. Diffraction limited by f/8. Off axis, very slight skew-ray flare mixed with very slight astigmatism and lateral color.

### LEICA R-4: FIRST LEITZ SLR FOR PROS?

#### MANUFACTURER'S SPECIFICATIONS:

Leica R-4 35mm single lens reflex camera. Body No. 1535483. LENS: 50mm f/1.4 Summilux-R (No. 2901943) in Leitz interchangeable bayonet mount, stops to f/16, focusing to 20 in. (0.5 m), accepts E67 accessories. SHUTTER: Electronically-controlled Seiko MFC-ES vertical-travel, metal-blade focal-plane with speeds from 1 to 1/1000 sec., plus B, X and 1/1000 sync speeds, electronic self-timer. VIEWING: Fixed eye-level prism with interchangeable focusing screen having central split-image rangefinder, microprism collar, and full-area fine-focusing microprism field. LEDs indicate shutter speed/aperture selected automatically, auto-exposure mode or manual operation, over, underexposure, or metering range, flash ready. Direct aperture and manual shutter speed readouts in finder. OTHER FEATURES: Two 1.5-volt silver-oxide batteries power shutter and silicon photodiode meter circuit. Cell in mirror chamber measures continuous light, full area or selective spot via fresnel secondary mirror for auto exposure in aperture-preferred (you set the aperture, camera sets the shutter speed) or shutter-preferred (you set the shutter, camera sets the aperture) auto-exposure, ASA 12 to 3200, full manual override,  $\pm 2$ -stop auto-exposure compensation, memory hold on shutter release, electromagnetic shutter release with mechanical release for B, 1/100 sec., provision for Minolta-type dedicated flash units, accessory motor winder and motor drive, removable back. PRICE: \$1695; with 50mm f/1.4 Summilux-R, \$3120; with 50mm f/2 Summicron-R, \$2175.

The Leica camera has always been a living legend. Generations of svelte and elegant 35mm rangefinder cameras have long established Leitz as the undisputed king of the rangefinder mountain. So—back in 1960—when rumors were rife that Leitz was soon to enter the SLR arena with a reflex to end all reflexes, many expected that it would be as compact and hand-holdable as a Leica M-3,

as bright and easy to focus as the magnificent Visoflex reflex attachments, and hopefully even able to take rangefinder lenses.

What we got instead was the original Leicaflex of 1964—a chubby, mechanically rugged, external-metering camera taking a whole new series of bayonet-mount lenses. It was evident at the time that Leitz still considered reflex focusing of wide-angle to normal lenses a questionable compromise at best, for the original Leicaflex had an astonishing focusing system—perhaps the most brilliant and clear reflex image yet seen. However, this commendable clarity was achieved by, essentially, viewing an aerial image over most of the finder area and focusing on a jumbo microprism screen in the center. Depth of field and indeed focusing itself could only be judged by observing the central focusing circle, in a manner similar to the famed Zeiss Contaflex. Since there was no way to stop the lens down for depth-of-field preview anyway, the point was, perhaps, moot. In short, Leitz had achieved a brilliant, parallax-free, precisely-framing viewfinder with precise focusing possible only in the center and no way to view the zone of image sharpness. It was, conceptually, very much like a rangefinder camera.

Although technically interesting, the concept was basically an interim compromise. People wanted full reflex viewing, not a surrogate rangefinder camera.

Succeeding Leitz reflexes solved that problem, and many others. The Leicaflex SL introduced depth-of-field preview, a new, thinner body shape, increasing focal-length options in the lens line, and the razor-sharp flare-free selective through-the-lens metering that has been the hallmark of Leitz SLRs ever since. The SL-2 added aperture readouts in the finder, extra metering sensitivity, a high-speed motor drive, and finder illumination. Through the development period, the basic lens mount remained the same while an additional cam was added to lenses as body and meter functions proliferated.

Gradually the wizards of Wetzlar shifted their focus from rangefinder to reflex, always at a safe distance behind the crafty camera-crafters of the orient. The shift from matchless quality match-needle metering to fully automatic must have seemed heretical to Wetzlar. Precision of construction and full control of image quality and exposure were paramount. How could convenience be important?

Yet the change did occur. In 1976, with the introduction of the Leica R-3, Leicaflexes became full-fledged Leicas for the first time, and Leitz had a reflex that could compete on the mass market for the first time, offering selective automation without sacrificing the premium quality synonymous with the name.

So a hybrid SLR was born out of Japan, as Wetzlar remanufactured and modified Minolta's redoubtable XE-7, converting it into a selective and averaging aperture-preferred automatic electronic SLR capable of supporting its standards. After the introduction of the R3 winder, some pros began to take the camera in hand as they searched for more durable hardware. But limitations in lens line-up, motor speed, and pro-oriented accessories held back full acceptance.

And so, at Photokina, in 1980, the R-4 was unveiled—a compact, solid, mechanically and electronically sophisticated camera with a broadened accessory range including a

most versatile automatic metering set-up. They termed it "the camera that can simply do everything." Operative here are the two words "simply" and "everything."

Let's look at "everything" first. The R-4 is the first Leica reflex to take both a 2-fps winder and a 4-fps motor drive interchangeably. But the big news is the exposure system. Taking the R-3 several steps further, the R-4 measures and exposes in five modes—selective manual metering (with full functioning meter), aperture-preferred full-area metering, aperture-preferred selective-area metering, full-area programmed exposure (both shutter speed and aperture change simultaneously in a program selected to minimize camera movement and maximize good results without thought), and shutter-preferred full-area metering. If you select the wrong (or shall we say inappropriate) speed, the camera will warn you and change it automatically until a good exposure can be obtained with the lens aperture range available to it.

Very much like the Minolta XD-11, you might say. Like the R-3, which was based on Minolta's now discontinued XE-7, the R-4 is a hybrid camera. You might say it's out of Japan, by Germany, assembled in Portugal. Taking some of Minolta's electronics, basic body parts, and shutter mechanism—with much earnest German redesigning and remanufacturing to hone the mechanics and further refine and add versatility to the electronic—Leitz has now transmuted the XD-11 into a camera capable of handling a 4-frames-per-second motor drive, taking interchangeable focusing screens, added programmed automatic operation and spot-reading capabilities in aperture-preferred and manual modes without increasing overall size and adding only 2 oz. to the weight.

Let's take a closer look at what we're being given for our money. This is the first SLR to offer, at the flick of a switch, automatic exposure (both full-area and selective-area types), programmed exposure for total hands-off automation, and shutter-speed preferred automatic exposure. In other words, exposure-wise it combines the virtues of the Minolta XD-11, the Canon A-1 and the previous Leica R-3—all with flick-of-a-switch convenience—and in a body scarcely larger than the XD-11. Why we need this multi-mode versatility and what we can achieve with these extra strings on our photo bow, we will find out shortly.

The R-4's a handsome brute that carries forth the rugged simplicity of the "Leitz look" in spite of its compactness. The black chrome finish hides a 1mm-thick zinc die-cast top plate while 0.8mm of brass protects the gearing in the bottom from shocks and over-enthusiastic tripod tightenings. Great care has been taken to shield and protect both the electronic and mechanical components from mechanical shock and the elements.

Starting at the top, with the right hand's control cluster, we have a smooth, 130° non-ratcheted wind lever with a plastic cushioned tip and a 45° standoff angle. Just to its right, a segmented window reveals a white frame counter dial with highly-visible, elegant black numerals. Just in front of the wind lever hub, a pentagonal film control window is black when the camera is empty and becomes progressively whiter when film is correctly inserted, and progressively blackens as one shoots through the roll. It provides an instant



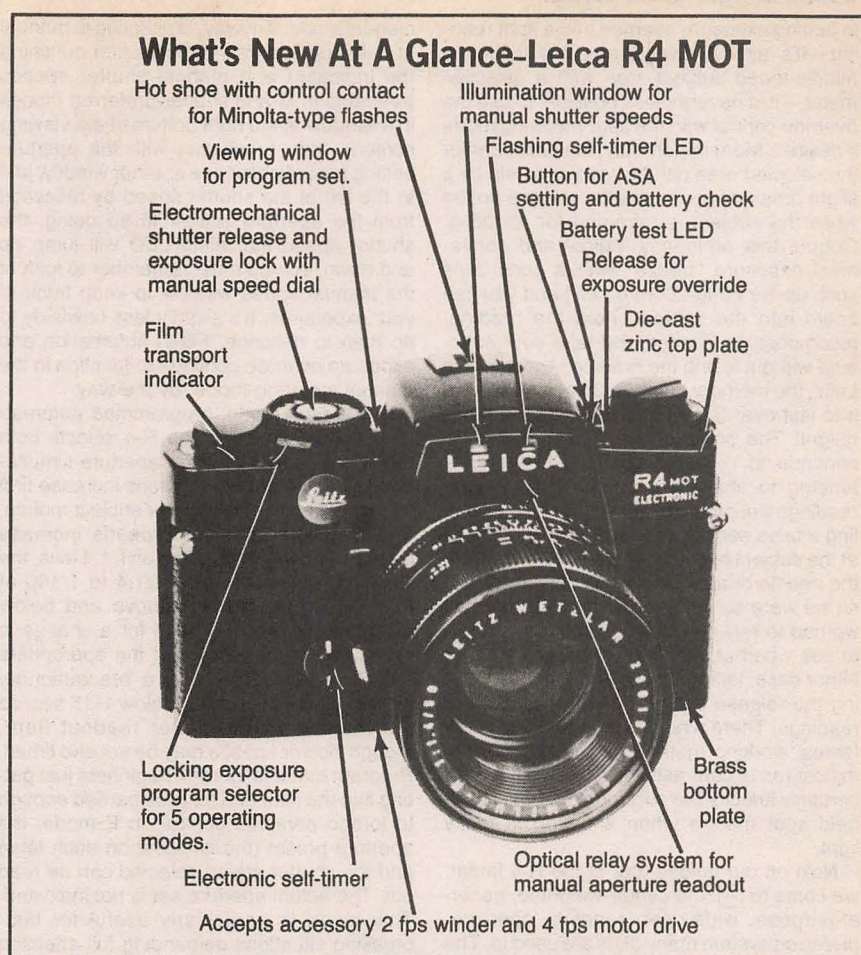
confirmation of correct film loading and a progressive at-a-glance guide as one shoots through the roll. Moving to the left, we find a ribbed, rubber-topped shutter-speed dial. It's black, with white numbers running from 1 sec. to 1/1000 sec., plus X (for flash), B (for long exposures without battery drain) and 1/100. Both B and 1/100 sec. are mechanically operated, will work with dead batteries, and are tripped mechanically by a secondary linkage to the Compur-threaded electromechanical shutter release in its center.

Depressing the release a mere 0.3mm, switches on the circuits, measured exposures at certain auto-exposure settings are memorized after 1 mm of travel, release of electronically-controlled exposure times occurs after you press the release in 1.3 mm; the mechanical release for B and 100 occurs after 2.25 mm of travel (figures supplied by Leitz). An easily-felt rest position prevents inadvertent shutter release quite effectively. No, you can't fire the R-4 with Minolta's X-series remote release switches. Remote tripping must be done through a normal cable release or a Leitz remote cord plugged into the winder or motor drive.

Just in front of the speed dial, and concentric to it, is the self-locking selector switch for metering modes. Pressing its central segment toward the shutter release unlocks it, permitting rapid selection of the metering mode, denoted by the symbols (M), (A), (P), and (T). The mode selected can be conveniently checked through a duplicate set of LED finder readouts. Let's save the wonders of mode selection and finder readouts for a second, and visit the left-hand controls first.

A well-executed rewind crank with pivoting, knurled grip is surrounded by a film-speed-setting dial with black on white ASA and DIN setting windows. The range of ASA speeds extends from 12 to beyond 3200. Depressing a small button toward the camera back releases the dial for setting and, simultaneously, tests the battery via a red LED directly in front of it. Unlike other battery-test circuits, this one is designed for a longer duration test. Hold the button down for 5 sec.; if the light dims, hie thee to a battery dealer or suffer soon the strictures of B-and-1/100-sec.-only photography. The test circuit is designed to give advance warning while there's still some energy available. An exposure override lever is coupled to the ASA ring, and offers plus or minus two stops of exposure bias when the  $\ominus$  button just in front of the LED is pushed. The exposure bias may be adjusted in 1/3-stop increments with full stops click-stopped, and is adjusted by a regrettably small metal tab just below the window. This makes it somewhat slow to set under pressure. Extenuating circumstances are offered, however. A flashing red  $\nabla$  LED in the finder provides a foolproof warning that override has been set and, when the camera is set for selective aperture-preferred metering, the shutter release locks your exposure reading (for a minimum of 30 sec.) when you press the shutter release in 1 mm. Since the ASA and override dials interact, full  $\pm 2$ -stop overrides can only be set between ASA 50 and 800. You cannot, for example, "add" exposure automatically at ASA 25 and "subtract" it at ASA 3200. This is the usual practice with exposure override systems.

Now let's get to the finder. At first glance, we see a cooler, contrastier viewing and



focusing image, seemingly higher in magnification than in a comparison XD-11. Leitz's semi-transparent mirror passes 30% of the light striking it to the metering mechanism, but the remaining 70% is so efficiently utilized that the finder image is brighter than competitive cameras with normal mirrors. Viewfinder magnification is claimed to be 0.85 with a 50mm lens.

Through-the-lensmount focusing screen interchange is featured for the first time in a Leitz SLR. It utilizes a special spring-loaded tweezer supplied with each screen.

In the center of each screen, a fine black line, easily visible yet not distracting, outlines the selective metering field used in aperture-preferred selective and manual metering. Shutter-speed and aperture scales appear along the right side of the finder image as needed (just outside of the field of view, as in the Minolta XD finders), while LED indicators for exposure mode and other functions and reflected digits for lens aperture, and manual shutter speeds appear along the bottom of the finder. All circuits are "go" once either the shutter release or the program selector lever is depressed (or in motorized use). Unique to the Leitz exposure display are its unusually brilliant exposure-indicating red LEDs, round for shutter speeds shorter than 1/30 sec. and apertures smaller than f/5.6. The appearance of a square LED serves as a warning to be careful—use a tripod for the slow speeds or focus with extra care because of limited depth of field at the widest apertures. Arrow heads above and below the scales indicate that the shutter speed or aperture preset is too high or too low respectively for accurate exposure, and should be modified. The top triangular LED also flashes when a suitably

dedicated electronic flash is fully charged. More on flash later!

The mode indicators along the bottom of the frame are a revelation in multi-function versatility. As you get to know them, they tell you more and more. Let's run through them in order.

First we have the  $\nabla$  triangle. This flashes on and off if you have set the exposure override adjustment off the standard setting by as little as half a stop. If it glows steadily, it's telling you that the light level is too low for accurate, linear exposure metering. EV limits at ASA 100 with an f/1.4 lens wide open are 1/4 sec. (EV3) in selective mode and 1 sec. (EV1) in full-area mode. Tri-X users may lose accuracy below 1/4 sec. at f/1.4 with selective readings and 1/4 sec. at f/1.4 for full-area readings. Individual cameras may make longer exposure—Leitz is conservative in its claims. Although not mentioned in the literature, the  $\nabla$  LED was said by Leitz experts, at Photokina, to serve as a system-OK. They inferred that it would light in cases of sudden environmental changes—bringing your camera in from the cold into a warm room, for instance—until the circuits restabilized, or to warn of circuit malfunctions.

Next in line is (A), for aperture-preferred, selective-area metering. In this particularly useful mode, exposures are based on a 7-mm-diameter area in the center of the viewing screen and are essentially flare-free. Lens focal length has little or no effect on metering accuracy; the reading area is accurately defined by the measuring circle. Measuring angles are 80° with a 50mm, 40° with a 100mm and a mere 10° with a 400mm Telyt.

Although there would seem to be little point



## 35MM Single Lens Reflex

in putting exposure override into a spot reading—it's almost always possible to find a middle-toned subject area with a selective meter—it is nevertheless possible to use the override control with the spot-metering mode if desired. More importantly, the exposure for the selected area can be read and held by a slight pressure on the shutter release button while the subject is reframed for shooting. Couple this eminently logical and convenient exposure "freeze" with a zoom lens such as the 75-to-200mm Telyt and you can zoom into the subject, hold the reading, recompose as desired and take your exposure without losing the reading. According to Leitz, the memory holds for 30 sec. We found it to last over 5 min. and the LED still didn't relight! The shutter-speed-indicating LEDs continue to register light level changes—tending to shake our confidence that the readings were indeed locked, but also dispelling a false sense of security that light levels at the subject had not changed. With the R-3, the needle dropped during exposure freeze, so we were sure the reading was locked but we had to rely on observation of the subject to see whether light levels had changed. In either case, letting up on, and then depressing the release again served to update our readings. There's no question that this is the fastest working method of getting accurate exposures of contrasty, or backlit subjects. It certainly knocks the socks off the best handheld spot meters when shooting in tricky light.

Next on our guided tour of the R-4 finder, we come to [A], the center-weighted, general-purpose, wide-open reading, aperture-preferred system many of us are used to. The R-4, in full-area modes, is two stops more sensitive than in spot modes (including manual exposure obtainable only with selective metering). Exposure override is the route to making creative exposure changes here. The exposure lock feature is not available and would be largely irrelevant in full-area metering. In any event, you can set the R-4's override to increments finer than half a stop and it's easy to see in dim light. However we judge that the XD-11's combined setting and release lever is quicker to use under pressure. Yes, you can override selective-area readings if you wish also, but we tend to use overrides with full-area metering and prefer to use the exposure lock when metering selectively.

The R-4's override works uniformly in all modes but flash, so that you can shift freely from manual through all the exposure modes without having to reset your controls. This makes sense—overrides are determined by subject characteristics and should hold constant for any metering method based on reflected light. You can't forget you're set for override—that flashing  $\nabla$  LED lets you know what's awry in all modes. We used full-area, aperture-preferred metering when we were in a hurry and our subjects were normal in tone.

In manual mode (denoted by a [P] on the mode control and in the finder), you're reading a 7mm-diameter area in the center of the screen. The metering system works normally, indicating the suggested shutter speed along the right side of the finder. When two adjacent diodes light, the recommended speed lies between—and, of course, cannot be set manually because of the discrete shutter-speed intervals most camera manufacturers seem convinced are necessary in the

manual mode. Anyway, bracketing in manual at half-stop intervals requires first matching the indicated and manual shutter speeds (readable in M and shutter-preferred modes in a window at the right bottom of the viewing screen), then bracketing with the aperture setting (as indicated in a another window just to the left of the shutter speed by reflection from the aperture scale). In so doing, the shutter speed indicating LED will jump up and down, so you must remember to look at the manual speed window to keep track of your exposures. It's slightly less unwieldy to do than to describe. Flash automation and exposure override continue to function in the manual metering mode, by the way.

In the next mode, programmed automatic—denoted by a [P], the R-4 selects both the shutter speed and the aperture simultaneously so that shutter speeds increase first to minimize risk of camera or subject motion, and then apertures and speeds increase together. At ASA 400, using an f/1.4 lens, the program runs from 1/8 at f/1.4 to 1/100 at f/11 (see table below). Above and below these light levels, the need for a change is indicated by the flashing of the appropriate exposure arrowhead. As a precautionary reminder, shutter speeds below 1/15 sec. do not appear on the finder readout here, though slower speeds may be set and timed. Program mode is for rank beginners just getting into the field and for pros harried enough to forego personal control. In P mode, the aperture preset (the smallest on each lens) and the shutter speed selected can be read out. The actual aperture set is not indicated. This mode is particularly useful for fast-breaking situations demanding full attention just to capture those "decisive moments." In most cases, the program chooses the same speed/aperture combinations that a pro would use for the vast majority of pictures.

Next, we come to [T] mode for time, or shutter-speed priority—denoted by a [T]. In this mode you get the shutter to the speed desired, the lens to its smallest aperture, and shoot away. The R-4 meters the whole picture field, sets the correct aperture for your preselected speed and displays it on the LED aperture panel that now replaces the shutter-speed indicator usually in view along the right-hand finder edge. This mode allows you to keep your shutter speed constant to minimize camera and subject movement.

Like the XD-11, the R-4 even corrects your mistakes. For example, suppose you've selected 1/250 sec. as your working speed, and the light drops so that your widest aperture is not wide enough. Your aperture indication has been dropping down the scale as the light decreases... then it disappears and is replaced by an arrowhead pointing downward just below the aperture scale. This means you have exceeded the diaphragm range available and will have to reset your shutter speed. Should you neglect to heed its advice, the camera will reset itself automatically as needed. Like the XD-11, the camera will not indicate the speed it's selected. If you want to know what it's doing, you'll have to change the speed manually until you get an aperture indication to know whether it was hand-holdable. Oh well—you can't have everything. The R-4 will make the best it can of a bad situation. The only thing you can do that it can't is to decide deliberately to underexpose (in manual mode) rather than risk camera movement.

One more exposure program is built in,

and that's dedicated flash. The R-4 will take any dedicated flash that will work with a Minolta X-series SLR, which includes Minoltas, Vivitars, Sunpaks, Brauns and Bogen so far. No doubt others will appear. When any one of them is plugged into the R-4's very solidly made and attached accessory shoe, it makes contact with the R-4 circuitry. When the flash is turned on with any exposure program selected, even manual, the top arrowhead will pulse when the unit's recharged, then the indicator will blank out as a signal that the camera has automatically set itself to the 1/100-sec. sync. speed. Fire the flash, and the shutter reverts to its available-light setting until the flash is ready again. Note that you must set the lens aperture manually.

The R-4's look of off-the-film flash exposure automation is the only area in which it lags behind the competition. We noticed, with curiosity, space for an additional contact reserved in the R-4's hot shoe, and can only speculate that future Rs may have even more flash automation.

Think we're done with the finder? Not yet—some of these mode-indicating diodes perform other tasks as well. When they glow steadily, everything is copasetic (or A-OK if you prefer). When they begin to flash on and off, they're warning you of errors you may have made. In both aperture-preferred modes, they have only one function. In T mode, a flashing diode indicates that you have forgotten to set your lens to the minimum aperture necessary to get full aperture adjustability and that the camera system will have to make exposure compromises within the shortened aperture range available to it. Exposures will be correct, but your shutter speeds may be nowhere near what you had in mind. Remember, the camera starts altering shutter speeds as soon as it runs out of diaphragm range. By setting a wider-than-minimum aperture you've shortened the range available—therefore... QED. An interesting option is opened up, however. Suppose you wanted to avoid using small stops in order to fuzz out a background slightly. You could set f/8 and go aperture-preferred, or you could go time-preferred at f/8 and work between maximum aperture and f/8, keeping as close as possible to your desired speed. It's an option that bears experimentation. The maximum automatic shutter speed of the camera will still limit your ability to lose background sharpness in bright light.

In P mode, the P diode flashes if you've forgotten to stop down fully, for the same reasons. If you fail to set f/16, ignoring the pulsating warning beacon, the camera will again operate within that portion of the program permitted by the aperture set. If you are at f/8, for example, only that the part of the program between f/8 and the maximum aperture of the lens will be work. Light levels calling for stops smaller than f/8 will increasingly overexposed. So pay attention to your P's cues.

Shifting our attention to the front of the camera, we find an 8-sec. electronic self-timer (ours ran 9.6 sec.) which flashes a red LED in the front right of the prism housing above the "C" in Leica. Two seconds before the exposure is made, the LED glows steadily as a warning to smile. The self-timer can be switched back to zero in the middle of a timed interval without damage, and can be overridden with the shutter release if desired.

Just above it, on the right side of the mirror box is the same generous and easy-working



diaphragm stop-down lever for depth-of-field preview found on the R3. Note that in T (shutter preferred) and P modes, when the lens must be set to f/16 or f/22 to operate, that is exactly what you'll get when you preview depth of field. If you want to preview at a given stop here, you will have to set the lens to it first, then return to f/16, etc. before exposing. The diode will flash to remind you, of course. This is a limitation shared by other shutter-preferred cameras, including the XD-11 and Canon AE-1. Since the R-4 does not require a lock on the diaphragm for this mode (the LED signal renders it unnecessary), it is easier to use than the competition even here.

The ribbed metal bayonet-lens lock-release lever sits right next to the self-timer where it serves as an index point to the raised red dot Leica bayonet-mount lenses have always featured. Line up the dot with the release, insert the lens, twist 45° clockwise and your lens is mounted solidly in the same heavily chromed, solidly mounted, brass bayonet mount used in the R-3, SL-2, SL, and the original Leicaflex. The solidity and durability of these mounts have been with us since the introduction of the M-3 and need little further comment. The R-4 takes, without modification, all lenses made or modified for the R-3—at least count 30 in number, spanning the range from 15mm to 800mm. Note-worthy in the lens mount design is the lack of delicate pins and levers on the lens bases, so lenses may be set down without back caps with relative impunity.

The right side of the mirror box carries a single female PC connector for studio and handle-mount electronic flashes. It is not recommended to use both shoe and PC guns simultaneously, though a Leica representative said it was regularly done with their other cameras without damage. Note that it is recommended that dedicated shoe mount flashes be switched off before mounting them. Failing to do so may result in damage to the camera circuitry—a hazard present to some degree with all dedicated hot-shoe cameras.

Pulling up on the rewind knob releases the swinging, removable camera back with its foam-padded, film cartridge viewing port, long pressure plate, and stabilization guides. Spring pressure is high enough to make accidental opening almost impossible. Opening the back reveals a straightforward, well-machined film race with well-polished guide rails. The film track is claimed to be shallower than that of the R-4, yielding greater film flatness and stability. The well-finished Seiko focal-plane shutter moves vertically with great smoothness and quietness, and has now been strengthened to permit use at 4-fps motor drive speeds. The mechanism has been tested for over 100,000 frames.

The design of the Leitz-originated, Minolta-adapted take-up spool is excellent. Its tabs are white for easy visibility, and their grip on the film leader tenacious, yet it's fast and easy to load. Loading the camera with or without the winder was positive and quick. We noted that the back was directly interchangeable with XD-11 backs, including the Minolta Data Back D which seems the basis for the Leitz' Data Back (not available for our tests). The Leitz backs feature a contoured film guide lacking in the Minolta equivalents—probably in an attempt to improve film flatness. The rectangular finder eyepiece is recessed enough to keep it from picking up grease from eyelashes, yet is easy to clean.

## GENERAL PERFORMANCE

| Checkpoints                                      | Our Standard                                                                                                                             | As Tested                                             |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| <b>FINDER:</b>                                   |                                                                                                                                          |                                                       |
| Apparent viewing distance                        | Between infinity and 20 in. (0.5m)                                                                                                       | 39in (1.0m)                                           |
| Apparent distance of shutter-speed scale and LED | Between 79in (2.0m) and 28 in (0.7m)                                                                                                     | 31in (0.8m)                                           |
| Apparent distance of aperture scale              | Same as above                                                                                                                            | 39in (1.0m)                                           |
| Viewing area compared to film area               | Vertically and horizontally more than 90%, less than 100%                                                                                | Vertical: 95.1%<br>Horizontal: 93.1%                  |
| Parallax error compared to film                  | Vertical: 0.59mm<br>Horizontal: 1.25mm                                                                                                   | Vertical: 0.05mm (Down)<br>Horizontal: 0.10mm (Right) |
| Focusing accuracy at maximum aperture            | Within depth of focus                                                                                                                    | No discrepancy                                        |
| Image magnification                              | 0.85X $\pm$ 0.1X                                                                                                                         | 0.87X                                                 |
| <b>PICTURE SIZE:</b>                             | 24 $\pm$ 0.6mm $\times$ 36 $\pm$ 0.9mm                                                                                                   | 24.4 $\times$ 36.3mm                                  |
| <b>SHUTTER:</b>                                  |                                                                                                                                          |                                                       |
| Curtain travel evenness                          | $\pm$ 0.33 stop                                                                                                                          | 0.04 stop                                             |
| Camera insulation from sync                      | More than 7 megohms                                                                                                                      | Infinity                                              |
| Sync contact efficiency                          | More than 60%                                                                                                                            | 93%                                                   |
| Synchronizer delay time                          | X: within full opening                                                                                                                   | Okay                                                  |
| Shutter curtain bounce                           | Not allowed                                                                                                                              | None                                                  |
| Self-timer delay time                            | 7-10 sec.                                                                                                                                | 9 sec.                                                |
| <b>LENS:</b>                                     |                                                                                                                                          |                                                       |
| Focal length                                     | 50mm $\pm$ 5%                                                                                                                            | 50.9mm                                                |
| Maximum aperture                                 | f1.4 $\pm$ 5%                                                                                                                            | f/1.45                                                |
| Distortion                                       | $\pm$ 2.5%                                                                                                                               | 1.1% Barrel                                           |
| <b>CAMERA SIZE:</b>                              | Body: 3½ in. high, 2½ in. deep, 4 7/16 in. wide (89 $\times$ 60 $\times$ 113mm)<br>Lens: 2½ in. long; 2 9/16 in. dia. (54 $\times$ 65mm) |                                                       |
| <b>WEIGHT:</b>                                   | Body: 1 lb. 5 oz. (60lg) with batteries<br>Lens: 14 oz. (403g)                                                                           |                                                       |

Viewfinder magnification is a nominal 0.85X, and the finder shows 92% of the negative format exposed. Next to the eyepiece, on the left, is a flattened, ribbed disk coupled to an eyepiece blind with the same white warning circle as that of the Minolta X series. The design of the knob makes it harder to turn the blind into position accidentally than the lever on the XD. Viewfinder accessories include push-on eyepiece-correction lenses and a periscopic right-angle eyepiece with adjustable diopter.

Upending the camera, we find three gold-plated contacts for motor and winder use, a screw-in battery compartment for two S76 batteries or the equivalent (with a neat hole to tell us whether a battery's inside or not), an ¼-in.-deep ¼  $\times$  20 tripod socket, large rewind release and double-exposure release knob and a recessed, countersunk female splined connector for the winder and motor. Just forward of the tripod socket, a single gold contact is set into the mirror box. Mounting a winder or motor pushes this contact in, bypassing the camera battery so that the whole system runs off the relatively huge energy capacity of the AA cells of the motor drive battery pack.

Proceeding to the Motor Winder R4, we find, not surprisingly, spring-loaded gold-plated winder contacts, locating pins, and motor-drive coupling to mate with the camera itself. The winder features a unique coreless motor with an unusual rubber, variable-pitch coupling that matches the drive power to the friction of the film cartridge in use. The motor housing is of die-cast aluminum, with a reinforced tripod socket inset into the bottom for rigid tripod mounting. The wider front carries an extra camera release for high-speed continuous firing (2 fps) an extra front-mounted ¼  $\times$  20 socket for the handgrip (which has its own continuous release), and a lever that releases the six-AA-cell battery pack to slide out for battery interchange or remote use. On the bottom, there's an extension for the rewind release lever, which can be switched for motor-driven multiple-exposure use, and a folding captive screw to fix the winder firmly to the R-4 itself. A clever tripod adapter engages in both the front and bottom ¼  $\times$  20 sockets to provide a doubly-strong, forward-extending platform to permit better balance with long telephotos and zooms on a tripod. In the back, a screw cap can be removed to expose a five-contact female socket for



## 35MM Single Lens Reflex

screw-in remote-release cables and the RC Leica R remote-control unit. Up to 100 ft. of cable can be used for remote tripping with either switching device. An infrared relay or a radio transmitter can also be used. The RC Leica R is an elegant unit featuring LED frame readout so you can keep track of the film supply in your remote camera (up to 99 frames). Users of the announced but not tested 250-frame backs will have to keep track in 99-frame increments. A two-speed intervalometer is built in that will time intervals from 0.5 sec. to 10 min. for time-lapse sequences. It can also be used as a long-interval delayed-action release for up to 10 min., and for making multiple exposures on a single frame.

Just to complete the picture, an audible beeper lets you know if you've left the motor in multi-exposure mode every time you depress any of the shutter releases.

In use, the winder was commendably smooth and quiet. The solidity of its construction inspired confidence. It is fairly heavy—containing six AA batteries instead of the customary four—so that use of the handgrip would seem desirable both for physical comfort and its relocation of the series release more conveniently to the camera top.

While we found its 2-frames-per-sec. speed nothing to write home about, the winder's smooth operation and quietness made it particularly unobtrusive. We also felt that a more positive lock on the battery compartment would be helpful; in handling the camera there was a tendency for the battery compartment to come loose and slide out. A piece of tape would be good insurance for the active photographer. It is claimed that 150 36-exposure rolls can be exposed with six alkaline batteries, so this shouldn't be much of an imposition. The serial release on the grip can be locked so inadvertent exposure of a whole roll can be avoided. Without the grip, the series release is exposed but slightly recessed so that accidents are unlikely. The top shutter release of the camera is not protected, though, and a steady pressure from being packed in a soft bag could depress the release long enough to light one or two LEDs and exhaust the battery, as it can with an XD-11. Pack with care to avoid this risk.

In spite of the R-4 winder's instruction that camera batteries must be in the camera to get an exposure impulse while the rest of the camera ran off the winder or motor batteries, we found the camera to operate perfectly with the winder (no motor was available for testing) with no batteries in the camera at all. It would be possible, therefore, to remove all camera batteries, pack the camera with the winder or motor attached and the battery pack snapped out and completely avoid the risk of inadvertent battery drain. The winder operates flawlessly with 36-exposure rolls, turning off automatically when the camera winder lever turns off the motor and allows manual winding—we were able to shoot one or two extra exposures per roll after the motor turned off. While the manual recommends use of 36-exposure rolls with the winder or motor, we shot 20s without damage to the film. At the end of the roll, a clutch slips, causing the motor to click repeatedly. If you don't stop shooting promptly a thermal relay turns off the motor. To get started, just pull the battery pack slightly out and then re-engage it.

The 4-frame-per-sec. motor drive was not available for testing. It is scarcely bigger than

### RESOLUTION

| Leitz Summilux-R 50mm f/1.4<br>at 1:49 magnification |                    |                    |           |    |
|------------------------------------------------------|--------------------|--------------------|-----------|----|
| f/no.                                                | Center<br>Lines/mm | Corner<br>Lines/mm |           |    |
| 1.4                                                  | V. Good            | 49                 | Excellent | 35 |
| 2                                                    | Good               | 49                 | Good      | 39 |
| 2.8                                                  | Good               | 62                 | Good      | 49 |
| 4                                                    | Good               | 62                 | Good      | 49 |
| 5.6                                                  | V. Good            | 69                 | V. Good   | 55 |
| 8                                                    | V. Good            | 69                 | V. Good   | 62 |
| 11                                                   | Excellent          | 69                 | Excellent | 62 |
| 16                                                   | V. Good            | 62                 | Excellent | 55 |

### CONTRAST

| Leitz Summilux 50mm f/1.4<br>at 30 lines/mm |          |          |      |    |
|---------------------------------------------|----------|----------|------|----|
| f/no.                                       | Center % | Corner % |      |    |
| 1.4                                         | High     | 62       | Low  | 28 |
| 2                                           | Med      | 62       | Low  | 30 |
| 2.8                                         | Med      | 70       | Low  | 36 |
| 4                                           | Med      | 72       | High | 60 |
| 5.6                                         | High     | 80       | High | 70 |
| 8                                           | High     | 76       | High | 70 |
| 11                                          | High     | 68       | High | 68 |
| 16                                          | Med      | 60       | High | 56 |

the winder, being only slightly higher to enable it to take 10 AA batteries in its slide-in compartment. Frame rates of 1, 2 and 4 fps are selected by a sliding switch on the front. Rewind with both is manual. Both share remote control and external battery pack options for sustained cold-weather use, and both are made by Eumig, known for premium quality motor-driven movie cameras.

Remove the R-4's lens and you'll see that the mirror box is well blackened (but not ribbed), and a complex lever system provides smooth and precise mirror control. Interchangeable screens are inserted by self-locking spring-loaded tweezers and held by a three-point system for focusing accuracy. The multicoated reflex mirror is generous in size to minimize long lens image cutoff, and the front of the camera is built out to accommodate the 3.4mm-longer back-focus of Leicaflex lenses. Hinged to the mirror is a glittering, multifaceted Fresnel mirror that reflects a maximum of light to the silicon photodiode in the camera bottom. In all metering modes but A, aperture-preferred selective, and m (manual), the cell leads the full area of the Fresnel screen. In spot-metering modes, an f/1.1, 45mm focal length lens slides in front of the cell to confine its reading to the 7mm circle at the screen's center. Selectivity and sharpness of cutoff are well-handled.

Leitz does not itself make a dedicated flash to work with the R-4. Braun 370 and 340 units with the relevant SCA R-3 adapters can be used, as can Minolta's 118X and 320X, the Vivitar 3500 and Sunpak 422B with Minolta modules have been tested and OK'd by Leitz. Turn off all flash units before inserting in hot shoe to insure safety of camera electronics.

When all is said and done, the R-4 pretty well justifies Leitz's claim—it is a camera that can simply do everything—or almost everything, anyway. While explaining its many options may seem confusing, in practice it is simple and straightforward to use. The system of diodes provides comprehensive and comprehensible information as to what's happening, exposure readouts are fast-acting and not confusing, and the clean-cutting spot reading in combination with on-the-shut-

ter-button exposure "hold" provides great potential accuracy with unsurpassed convenience.

The international meld of Asian electronics with German optics and mechanics has resulted in a professional-grade camera that even a beginner can feel at home with.

Included with the R4 was the latest Wetzlar-made 50mm f/1.4 Summilux-R. The lens is large on the more compact R4 body, a bit heavy, protruding 2 in. with its collapsible sunshade in closed position, is 2 in. in diameter and taking 55mm screw-in filters. As would be expected in a German-made lens of this calibre, mount construction and smoothness of focusing were superb. A silky 270° turn of the ½ in. ribbed focusing ring takes one from infinity to the 20 in. near focusing distance. Bright yellow English and white metric and aperture figures are engraved very legibly. A short telescoping shade is coupled with the deeply recessed front element to give good protection from sidelight.

**Optical bench analysis:** In the center of the image field at f/1.4, we saw slight flare and slight spherical aberration, but by f/2.8 it was virtually gone. By f/5.6, the pattern was nearly perfect, approaching diffraction limited performance. Off-axis, wide open, we saw very slight astigmatism and slight purple-yellow flare. By f/5.6, these aberrations were greatly reduced, and gone by f/11. A very slight trace of lateral color was observed throughout.

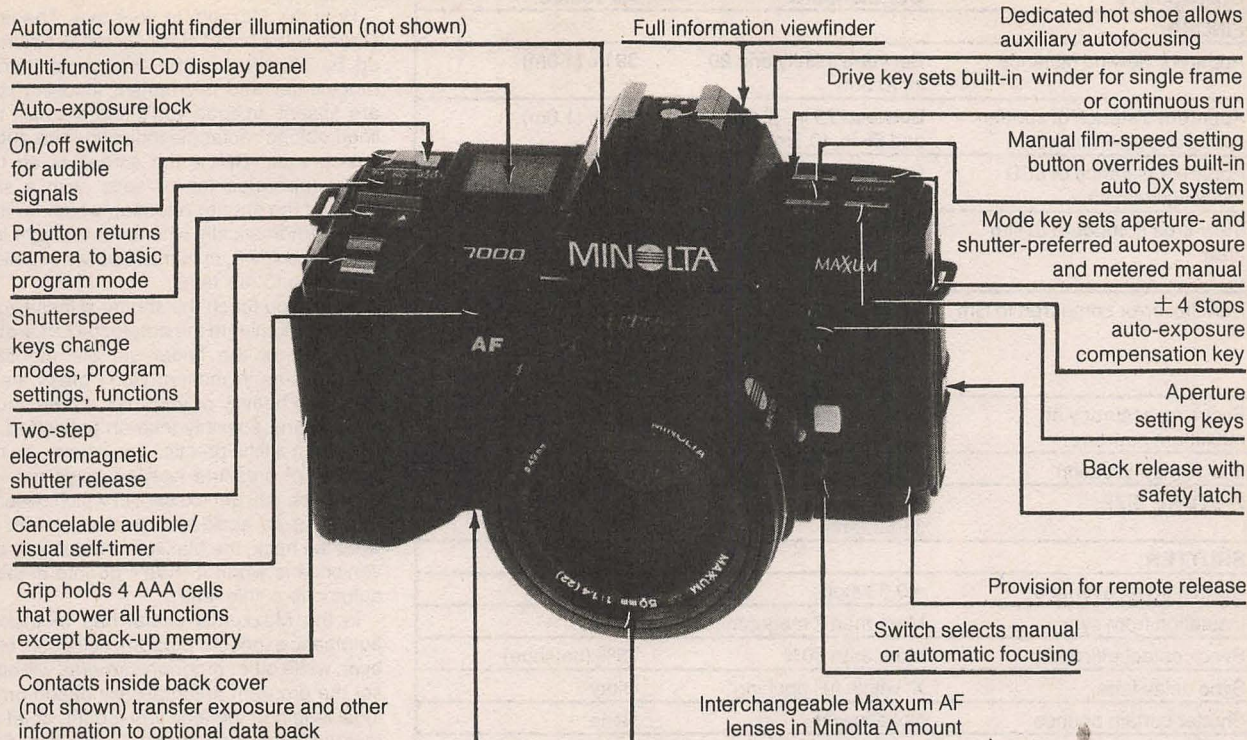
**Field test slides:** In our field test transparencies, we found flare to be well controlled throughout, with only small, weak ghosts in evidence even in pictures shot against the sun. Wide open, contrast was moderate, but by f/2.8 results were contrasty across the picture field. As with most high speed lenses, pictures shot at maximum aperture showed good detail but there was a slight softness. (November 1981)

## MINOLTA MAXXUM: FIRST 35MM AUTOFOCUS SLR SYSTEM

**MANUFACTURER'S SPECIFICATIONS:** 35mm auto focus, multi-mode SLR. Body # 13002626. LENS: 50mm f/1.4 Maxxum AF in interchangeable Minolta A Bayonet, No. 1048039. SHUTTER: Electronically-controlled metal and plastic blade, vertical travel Copal focal-plane, with speeds from 30 sec. to 1/2000 sec., plus B (stepless in automatic modes, full stop in manual). 1/100 sec. flash sync. EXPOSURE SYSTEMS: SPD cell atop pentaprism measures ambient light off focusing screen for auto-selected programs, aperture-priority AE, shutter-priority AE, metered manual; compensation + 4 stops in ½ stop increments, AE lock, user-selected program shift, auto DX or manual film speed settings from ISO/ASA 25 to 6400, metering range: EV -1 to 20 with ISO/ASA 100. FLASH: 4-pin dedicated hot shoe. Reads TTL flash directly off film via SPD cell in bottom of mirror box. Auto sync speed setting. VIEWFINDER: Fixed eye-level pentaprism with interchangeable focusing screens. Standard matte screen has central rectangular auto-fo-



## What's New At A Glance: Minolta X-7000 Maxxum



cus frame. LCD display panel indicates exposure mode, exposure adjustment, shutter speed, aperture, program shift, film speed, low battery, over and under-exposure warnings out of meter range. Auto LCD panel light. LEDs indicate focus, flash ready, flash exposure confirmation. OTHER FEATURES: Built-in motors drive focusing mechanism of lens, auto loading motorized wind for single frame or continuous advance up to 2 fps, and auto rewind. LCD panel atop camera displays settings, modes, film speed, frame number. Reset button returns settings to basic program. Manual focusing provision. Cancellable audible signals for focus confirmation, end of roll, slow shutter-speed; cancellable 10 sec. self-timer, provision for data and control back; provision for remote release. BATTERIES: 4AAA alkaline batteries power all operations, lithium cell provides memory backup. PRICE: \$477.00.

No, the Minolta Maxxum isn't the first SLR with built in autofocus. That distinction, surprisingly, belongs to a U.S.-made camera, the Polaroid SX-70 Sonar of 1978. However, the Maxxum 7000 has the honor of being the first 35mm SLR designed as a full autofocus camera system from the very first engineering drawing. Taken individually, few of the Maxxum's impressive list of features would be considered world "firsts" but in concert, they do represent the often sought after but seldom achieved, giant leap forward in SLR technology.

It's doubtful if any camera manufacturer has ever staked so much on one single camera model—including the Leitz introduction of the very first Leica in 1924. Minolta had to decide whether to make or not to make a radically new, highly complicated, non-compatible camera system with all accessories including an entirely new lens series—an

incredibly daring financial gamble. The stakes were so high in terms of cost that to fail might have crippled Minolta utterly and permanently. It is to Minolta's everlasting credit that the company saw the opportunity for photographic immortality (and for gaining a sizable percentage of the SLR camera market) and seized it.

Who would buy such a camera? The easiest avenue would have been for Minolta to follow the low road and produce an autofocus SLR catering to the snapshotter only, a known market ever since the simple lens-shutter autofocus camera skyrocketed in camera sales beginning with the Canon Sure Shot of 1979. Such a decision would have required a minimal camera system with a limited number of lenses and a consequently modest (in comparison) budget.

A professional autofocus SLR system would have needed far more lenses and accessories but with its limited sales potential (there being far more amateurs than pros) would have required an astronomical sale price.

So like Goldilocks, Minolta took the middle road—not too hot and not too cold, not too soft and not too hard, not too small and not too large, but just right. The company aimed broad center at everything from the tyro to the advanced amateur and scored a clean knockout which not only shocked their competitors, but, we believe, even surprised Minolta with its complete success.

Unlike the traditional introduction of a new camera where the body and a limited number of accessories are first made available with the promise of the rest "soon", Maxxum dealers had everything in the present catalog (save two items which we'll discuss later).

In the rush to proclaim the glories of a full autofocus 35mm SLR system, too many overlooked the rest of the Maxxum itself which backed up autofocus with a dazzling

array of high tech multi-featured conveniences never before found on a single camera. It seemed, and in our careful and exhaustive tests proved to be, truly the auto-everything SLR: auto-loading, auto film speed setting, auto exposure program changing, auto winding, auto rewinding, auto finder illumination, and auto flash setting. Using an imposing array of sleek, ergonomically placed buttons and watching easily visible display panels atop the camera and within the finder, you can control a vast array of exposure modes, variations and overrides, meter manually, focus automatically or by hand. And although it can well be argued that the Maxxum has the most complex array of features of any camera to date, it is remarkably free of superfluous doodads and incredibly can be run successfully by a rank amateur with little or almost no knowledge at all!

Has Minolta then conceived and built the perfect SLR? We cannot say it has. While its successes far outnumber shortcomings, shortcomings there are, some of which can be sidestepped and some not. So let's scrutinize this fascinating (and admittedly fun-to-use) camera most carefully.

While the rubberized surface right hand grip seems a trifle bulky at first, you will quickly admire the secure, well balanced hold it provides even when you mount a zoom lens on the camera. Your index finger will fall quite naturally on the double barred electromagnetic shutter release button. From there, a slight shift of your finger will allow it to find the multi-function shutter-speed keys. The aperture-control keys on the top left side of the lens mount, the manual-autofocus selector and top control keys are all logically positioned so your digits can find and operate them conveniently. Yes it is true that you will need an hour or so of dry runs to familiarize your fingers so they will operate all controls instantly at your command if you're



## GENERAL PERFORMANCE

| Checkpoints                                           | Our Standard                                                                                                                                                                         | As Tested                                          |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>FINDER:</b>                                        |                                                                                                                                                                                      |                                                    |
| Apparent viewing distance                             | Between infinity and 20 in. (0.5m)                                                                                                                                                   | 39 in. (1.0m)                                      |
| Apparent distance of shutter-speed and aperture scale | Between 79 in. (2.0m) and 26 in. (0.7m)                                                                                                                                              | 39 in. (1.0m)                                      |
| Apparent distance of LED focusing indicators          | Same as above                                                                                                                                                                        | 46 in. (1.2m)                                      |
| View area compared to film area                       | Vertically and horizontally more than 90%, less than 100%                                                                                                                            | Vertical: 93%<br>Horizontal: 93%                   |
| Parallax error compared to film                       | Vertical: 0.9mm<br>Horizontal: 1.3mm                                                                                                                                                 | Vertical: 0.05mm (up)<br>Horizontal: 0.05mm (left) |
| Focusing accuracy at maximum aperture                 | Within depth of focus                                                                                                                                                                | No discrepancy                                     |
| Image magnification                                   | 0.85X $\pm$ .1X                                                                                                                                                                      | 0.86X                                              |
| <b>PICTURE SIZE:</b>                                  |                                                                                                                                                                                      |                                                    |
|                                                       | 24 $\pm$ 0.6mm x 36 $\pm$ 0.9mm                                                                                                                                                      | 24.4mm x 36.3mm                                    |
| <b>SHUTTER:</b>                                       |                                                                                                                                                                                      |                                                    |
| Curtain travel evenness                               | $\pm$ 0.33 stop                                                                                                                                                                      | 0.19 stop                                          |
| Insulation from sync                                  | More than 7 megohms                                                                                                                                                                  | Infinity                                           |
| Sync contact efficiency                               | More than 60%                                                                                                                                                                        | 78% (hotshoe)                                      |
| Sync delay time                                       | X: within full opening                                                                                                                                                               | Okay                                               |
| Shutter curtain bounce                                | Not allowed                                                                                                                                                                          | None                                               |
| Self-timer delay                                      | 7-15 sec.                                                                                                                                                                            | 10 seconds                                         |
| <b>CAMERA SIZE:</b>                                   |                                                                                                                                                                                      |                                                    |
|                                                       | Body: 5 $\frac{9}{16}$ in. wide, 3 $\frac{5}{8}$ in. high x 2 $\frac{3}{8}$ in. deep (143 x 92 x 60mm)<br>Lens: 1 $\frac{9}{16}$ in. long, 2 $\frac{9}{16}$ in. diameter (40 x 65mm) |                                                    |
| <b>WEIGHT:</b>                                        |                                                                                                                                                                                      |                                                    |
|                                                       | Body: 1 lb. 5 $\frac{3}{16}$ oz. (601g) with batteries<br>Lens: 8 $\frac{1}{4}$ oz. (235g)                                                                                           |                                                    |

going to make full use of the Maxxum's abilities (which we hope every red blooded MODERN-reading owner would). After shooting a few real rolls, you will find that you never have to take your eye away from the finder to search for any control. However it is equally true that should you wish to shoot today and learn tomorrow, you can stay in the tyro mode: leave the Maxxum in the regular fresh-out-of-the-box program mode, load batteries and DX film, mount lens and away you go taking pictures of whatever you aim at.

Let's get the Maxxum operational. Hurrah, no pesky small button batteries to slip through your fingers, get inverted in the battery chamber wrong or to drop dead with oxidation in humid weather. Like a number of the other modern breed of SLRs the Maxxum is powered by four alkaline energizers, in this case AAA cells. Turn the slotted thumbscrew on the camera's right side with coin edge or finger pressure and insert the batteries into the handgrip as indicated in the holder. But read the camera instructions carefully as to how you must insert the fourth battery which can be a little tricky since you must pivot the battery holder to reach the fourth battery slot. Snap the holder closed and screw it into the side of the camera. However, there is a slight interlocking glitch here. Should you fail to set the main switch to "lock", the (it's powered by a service-station-replaceable, claimed 10-year life lithium cell) memory won't retain mode selections or any manual settings. But it will "remember" everything you need to take pictures, namely the frame number and ISO/ASA film speed setting. Other settings will return to a basic program mode, single frame advance, auto film speed setting.

We're now ready to load film. Press the grey button on the camera's left side and slide the bar down. The back unlatches. You can now swing it open to reveal the well finished Maxxum interior with its all metal focal plane and invisibly bonded polycarbonate-to-metal traditional hybrid body construction Minolta uses on its modern SLR camera bodies. Gleaming from the inside of the left hand film chamber are 6 sets of double spring loaded electrical contacts which provide automatic DX film speed setting when DX coded film cartridges are inserted. The double contacts assure proper connections. Along the bottom of the film plane are nine contacts to provide the proper electrical connections for the Maxxum's accessory data backs.

To load, angle the cartridge slightly to catch the rewind claw at the top of the film chamber, then pull the film leader across the film plane to the red rectangle. Close the back and slide the main switch atop the camera to the "on" position. The camera will automatically wind film, emulsion side in, to frame 1.

The top of camera LCD panel should now show the ISO/ASA film speed and a 1 (the frame number) in a small box labeled "film". If a zero appears instead, the film wasn't loaded correctly. (In our tests, we had no incorrect loading as long as we followed Minolta's instructions.)

If the film is not DX coded, the camera will automatically set it to ISO/ASA 100. Should you wish to change this, or to alter the film's DX-coded setting, press and hold the ISO key atop the camera with your left hand. While doing this, you must push the blue

shutter speed keys behind the shutter release until you get the film speed you want on the LCD panel.

Hold the Maxxum to your eye. The finder screen is the bright clear Accumatte pioneered by Minolta but the familiar split-image rangefinder and microprism focusing collar are absent. Instead you'll find a small, thin-lined oblong rectangle indicating the autofocus area. Below the screen is an LCD panel (activated for 10 secs. with a slight touch of the shutter release), which is illuminated automatically whenever the light level falls below EV 8, or in most indoor situations, according to our tests.

When you touch the shutter release lightly you also illuminate the autofocus LEDs at the lower left of the finder set the autofocus mechanisms in motion. Don't press the release too heavily or you'll set off the shutter release and possibly take an unwanted picture. With a little practice you'll have the right amount of pressure needed down pat—except when you get excited, in which case you may take an accidental picture or two. But what the heck, the Maxxum's autofocus convenience is worth it. (We'll go into detail on autofocus a little later).

In the Maxxum's useful bag of tricks is automatic exposure program selection. However, while other program cameras will either set the program automatically based on the focal length of the lens you mount, or let you manually select an "action," "depth-of-field" or intermediate program, only the Maxxum will change programs automatically as you zoom. For example, when shooting with the 28-135mm Maxxum AF Zoom in Program mode you may notice that the camera-selected shutter speed will be 1/60 sec. at the 28mm setting, 1/250 sec. at intermediate focal lengths and 1/500 sec. at the 135mm tele setting. The Maxxum selects both shutter speed and aperture. Each Maxxum lens has a ROM (read only memory) chip built in which sends signals to the camera's Central Processing Unit (CPU), which then chooses the proper program depending on the lens's focal length and shifting programs when you zoom from wide angle to tele (see chart left). But suppose you aren't satisfied with the Maxxum's program choice and you want to do your own thing while remaining in program mode. Maxxum will let you do it in three ways.

If you want to change the actual exposure, there are the usual auto-exposure compensation and memory locks which work in all Maxxum auto-exposure modes. For exposure compensation, you hold down the "+/-" button atop the camera while pushing either of the two blue shutter-speed keys. Exposure adjustment appear in  $\frac{1}{2}$ -stop increments on the LCD panel. When you release the controls, the new program's apertures and shutter speeds appear along with a warning + or - signal indicating that compensation is in effect. You can set the exposure compensation without removing the camera from your eye since the necessary info also appears on the finder's LCD panel.

The second means of altering exposure is by using the memory lock. At the rear of the Maxxum, convenient to your right thumb, is the memory hold AEL button. Press it and your exposure reading remains frozen, as long as you hold it—a useful feature for making closeup readings in backlit situations.

The preceding exposure controls, which,



in effect, override the auto-exposure system, are common, but if you don't want to change the exposure, but do want to use other shutter speeds or apertures, the Maxxum provides a third, uncommon, alternative: shifting the entire auto-exposure program. For example, suppose you want a program with faster shutter speeds than the tele lens "action" program provides. You can change the program's shutter speeds using the blue shutter keys behind the shutter release. Press the right-hand key and the shutter speed displayed gets faster; the aperture display shows a correspondingly wider aperture, and the P flashes to indicate you've shifted programs. Even if the light level changes, you'll still get faster shutter speeds than you would ordinarily have with the unshifted program.

Want a smaller or larger aperture than the regular program provides? Use the aperture keys atop the camera in the same manner and the programs apertures will change, with an appropriate shift in shutter speeds to maintain the proper exposure.

These program shifts can also be made without removing your eye from the finder. However, if you do, the word Program in the LCD panel atop the camera flashes in warning. As soon as you remove your finger from the shutter release after taking a shot, the camera resumes unshifted program operation. If you maintain finger pressure on the release the program shift remains in effect—useful when shooting sequences. How far can you shift programs? As far as you want in either direction until you reach the limits of possible shutter speeds, or apertures with the lens you are using, at which point holding in the keys has no effect.

If you wish to retain a bit more exposure control than the program offers, the Maxxum has both aperture- and shutter-speed priority auto-exposure modes plus metered manual control. Using the top camera "mode" key and the blue arrow (shutter-speed) keys, you can switch to aperture-preferred or auto exposure (an A appears on the LCD panels), shutter-priority (an S appears) or manual (M display).

In aperture-priority, pressing and releasing the rounded blue keys, on the left side of the lens mount, shifts your lens openings in  $1/2$ -stop increments either up or down depending on which key you push. Shutter speed shifts accordingly. Holding the arrow key in allows continuous aperture shifting. Should you get beyond the possible shutter speed range, either the 30 sec. or 1/2000 sec. indicators on both finder and top-mounted LCD panels will blink in warning.

Besides the out of exposure range blinking, the Maxxum is also designed to prevent you from accidentally making pictures at shutter speeds which are too long to hand-hold securely. Therefore in all auto exposure modes it beeps (or more accurately, chirps) continuously when you press the shutter release should you be using a shutter speed below 1/30 with wide angles to 35mm; below 1/60 with lenses from 35mm to 105mm and below 1/125 with lenses from 105mm upwards. With zoom lenses, the beep warning point even changes as you move from one focal length range to another. Like all of the Maxxum's audible warnings (which include correct focus and end of roll warning) the beeper can be turned off so you won't go around beeping when it might prove embarrassing.

Shutter-priority controls are much the same except you use the blue shutter-speed keys adjacent to the shutter release. Shutter speeds can be set in full stop increments only. Maximum or minimum aperture numerals will blink if you try to exceed the exposure range.

For full manual control, you operate both sets of arrow keys. If the exposure you set is beyond  $1/4$  stop from the camera's recommended exposure you'll see a single arrow in the finder—it points up to indicate overexposure and down for underexposure. When both arrows light, the exposure is correct within  $1/4$  stop according to the camera's metering system. While this method of manual control is sufficiently precise, bracketing exposures quickly is not its forte. However, Minolta has a special goodie coming for bracketeers, providing the Maxxum with the first auto bracketing system ever. We'll get to it later on.

In the manual mode, you can also make B (or bulb) exposures. If you do, the frame number area on the LCD panel becomes a timer indicating the number of elapsed seconds in your exposure. In like manner the frame counter also switches to a timer indicating the number of seconds remaining when you use the Maxxum's 10 sec. self timer. To set it, hold the 'DRIVE' key and press the shutter keys to select 'S.T.' in the LED display. When you press the shutter release, the LED on the front will flash twice each second for the first 8 secs, then more rapidly for 1 sec. During the last second the LED stays lit. If the beeper is on, the camera will chirp each time the LED lights. For normal shooting you will probably want to keep the Maxxum in its single frame mode which will automatically advance the film one frame after each exposure whether you keep your finger on the shutter release or not. However, you can shoot sequences by pressing the 'DRIVE' key atop the camera in which case a C (for continuous) will replace the S (for single shot) on the LCD panel. In C mode, you can shoot up to 2 frames per sec. by maintaining continuous pressure on the shutter release according to our tests.

The motor that drives the lens to focus is located in the bottom of the camera body. This motor within the camera body drives the lenses' focusing mechanisms to the point of proper focus via a keying mechanism on the lens mount which meshes with a recessed slotted rod end at the back of each lens.

Which autofocus system did Minolta decide to use? Besides the high frequency sound autofocus system used by Polaroid on its Sonar cameras (which requires a largish round sender-receiver unit mounted atop the lens), there are only two major autofocus systems in use today. Most non-interchangeable, leaf shutter 'point and shoot' flash cameras use an active infrared system which sends an invisible 'light' beam to the subject. By measuring its angle of reflectance through a second window (or a series of windows), the subject distance can be determined by triangulation. This system works well in any ambient light up to about 30 ft., after which the light beam is too weak to provide a proper return signal. However, its range is sufficient for the moderate-aperture, semi-wide-angle lenses usually fitted to the cameras which have such systems.

For SLRs, an autofocus system must work both at short and long distances if it is to focus accurately not only with wide-angle

lenses but also with teles and zooms. 35mm SLRs have therefore used passive autofocus systems which don't send out any beams but instead analyze the subject sharpness much as you do in focusing manually. Minolta opted for what is known as a phase comparator autofocus system using CCD (charged coupled device) sensors placed in the bottom of the mirror housing.

Like the human eye, passive autofocus systems have low light focusing limitations. When light is too low, they just can't "see" well enough to focus accurately or to focus at all. Maximum lens aperture and lens transmission both limit the light which reaches the AF sensors. Nevertheless the Maxxum works in the lowest light level of any passive AF camera to date—EV3. This is equivalent to f/1.4 at  $1/4$  sec. using ISO/ASA 100 film, or a dimly lit interior.

We tested several lenses and found that all but three can focus from infinity to closest distance or vice-versa in less than 1 sec.! The 300mm f/2.8 and 70-210mm f/4 required 1.2 sec. while the 50mm f/1.4 required nearly 2 sec. to reach infinity from 1:1 magnification or the other way around. Very impressive indeed. Actual focusing times may be longer at low light levels or with certain subjects.

To prevent the possibility of producing an out of focus image, the Maxxum's shutter release remains locked until proper focus occurs. Red LED arrows in the finder light while the lens is focusing to indicate the direction the lens helical is turning (for those Maxxum lenses which have helicals, several feature internal focusing). When focus is correct, a green circle appears, an audible beep is heard and the shutter lock is released so the picture can be made. However, should the light level be too low or the subject lack sufficient contrast to allow accurate focus, the red arrows continue and the shutter remains locked. You must then move the switch at the lower, left-hand part of the lens surround from AF (autofocus) to M (manual) and focus manually using the fine focusing screen. (Should you wish however, you can replace the autofocus rectangle screen with the Maxxum type PM which has a regular split-image rangefinder and fine focusing collar which, we suspect, many Maxxum owners will prefer to do.)

The Maxxum autofocus system will not continuously focus to maintain proper focus on a moving subject. Should you not press firmly down on the shutter release to take the picture, the focus locks and continues to show a green correct focus circle as long as you hold your finger on the shutter release. However, the exposure will vary as will all exposure readouts if the light level changes.

As you can see it's entirely possible to get a green focus OK and beep signal, press the release and make unsharp pictures if you don't shoot moving subjects immediately in response to the autofocus signal. If you don't take the picture immediately, we'd suggest you remove your finger from the release and begin the process over again by reapplying pressure to obtain a new autofocus point. In trying to shoot additional shots of the same subject, it's also convenient to put the camera on the S sequence setting so that it will recycle immediately and refocus automatically following exposure even if you don't remove pressure from the shutter release. Although this method is preferable for shooting action sequences it does not constitute a true 'continuous AF' mode and you may wind



## 35MM Single Lens Reflex

up wasting a few frames.

If you must follow focus action (particularly if it is moving rapidly toward or away from you), if light or contrast is too low for accurate autofocus, or if the subject has repetitive lines which the autofocus system has trouble phasing properly (see examples above), both red arrows blink in warning and you must switch to manual focus the lens's focusing ring after sliding the aforementioned AF-M switch to M. If there's sufficient light the red arrow, green circle and focus OK beeper still operate to confirm correct focus indicate focus confirmation, but in most cases, if you can't get a green circle and beep in AF mode, the circle and beeper won't operate in manual (M) focus mode either..

The lenses do focus very smoothly with a well damped action in manual mode (but don't try focusing manually without shifting from AF to M. If you do the lens focusing moves with great difficulty and possible camera damage can result). We would have preferred, however, broader manual focusing rings on the lenses we used.

The internal autofocus system of the Maxxum—its ROM-chip carrying lenses and aperture setting circuitry contained in the camera side itself—presented Minolta with a necessary lens mount decision bound to be unpopular with present Minolta camera owners as far as lens compatibility is concerned. The mount in use since the original Minolta SR-2 of 1958 simply would not do. If Minolta was to enter the new age of photo electronics and provide all the conveniences for users as planned, a new lens mount was necessary which, alas, would not allow other Minolta lenses to be mounted or operate directly on the camera. Present Minolta lenses can only be attached to the Maxxum indirectly for manual diaphragm, aperture- preferred auto or manual exposure without autofocus but only if the planned Minolta 2X teleconverter is used. Additionally this will reduce the aperture by 2 stops, a proposition which will prove less than satisfactory to most Minolta lens owners. But the combination of the Maxxum's initial sales success and Minolta's willingness to cooperate with other camera and lens manufacturers gives promise of a broadening range of non-Minolta made autofocus-capable lenses soon. The new mount is a 3-pronged bayonet, slightly larger than the original Minolta mount. To remove a lens press the lens-release button to the left of the lens, turn the lens about 60° counter-clockwise and lift it off. To mount lens match the red dots on barrel and mount and turn the lens clockwise until it clicks in place.

While there are no autofocus extension tubes, bellows units or perspective control lenses now or in the foreseeable future, already we have noted ads for Maxxum-mountable manual and preset tele lenses plus fixed aperture mirror lenses. These must be used in aperture- preferred auto exposure or manual modes but without full LCD panel information.

As far as attaching the Maxxum to a telescope or microscope, the same operational rules would apply as with any other SLR (once an adaptor for such use is available which it isn't as of this moment): use it manually or in aperture- preferred auto exposure mode but not with autofocus or focus indication.

Flash is an essential ingredient in the popularity of any camera today. But flash is generally used when there is not sufficient

ambient light to make a picture. In such lighting how can a camera such as the Maxxum 'see' well enough to autofocus? As we've seen, by itself it can't autofocus below an EV3 light level. Must you then resort to manual focus for most flash shots? Happily not. If the Maxxum needs light on the subject, Minolta will supply it. If you press the Maxxum shutter release lightly with the fully dedicated, Maxxum 2800AF flash unit in the hot shoe, a near infrared light beam is emitted from the dark panel just below the flash reflector whenever ambient illumination falls below EV6. The IB beam projects two irregular patterns (similar to the product codes used at supermarket checkouts) onto the subject. The Maxxum autofocus system can focus on it up to about 16 ft., with other flash units, you must use manual focusing.

The Maxxum, not surprisingly, offers TTL autoflash exposure control via a SPD located in the mirror box which reads the flash illumination directly as it's reflected from the film surface during exposure. The finder has a flash ready signal and flash confirmation if there is sufficient illumination (provided a Minolta compatible flash unit is used).

Autoflash with or without additional ambient light fill-in is available in all modes as well as manual control. Besides the 2800AF flash which offers a maximum manual guide number of 99 with ISO/ASA 100 film but no bounce capability, Minolta plans to introduce this year the Maxxum Flash 4000AF. In addition to more power (GN. 1132 for ISO/ASA 100 film), the 4000AF will have a power zoom head which zooms automatically to match the lens's angle of coverage, from the angle of a 28mm wide angle to a 70mm tele—even changing during a zoom, two way bounce capability, variable power output, and an LCD control panel.

For off-camera flash, there's a special accessory pack consisting of the flash distance checker (FDC) that's placed atop the camera, an autofocus illuminator and a Control Grip CG-1000 which holds the flash and additionally will provide a balanced flash-ambient light ratio of 2:10. Eyepiece correction lenses, remote release cables (you can't use a regular cable release) and a Program Back 70 round out the present accessory range.

While the Program Back 70 features an interval release system and offers long exposures from 31 sec. to over 9 hrs. its ability to imprint sequence, time, date or selected numbers on film is quite typical of many SLR data backs.

The "soon to be available" Program Back Super 70 is as untraditional a back as the Maxxum is a camera. It can imprint the actual shutter speed and aperture used for the exposure, receiving this information from the camera itself at the moment of exposure. This data, instead of being placed within the regular picture area, is recorded along the right edge of the frame, normally masked by the slide mount or not printed from the negative during enlargement. The back, with its LCD control panel, can also be used to create your own exposure programs. It will also automatically bracket sequential exposures for you up to 9 frames in  $\frac{1}{4}$ ,  $\frac{1}{2}$ , 1 or 2 stop intervals, thus making Maxxum the first true auto-bracketing camera. All functions can be combined if you wish to produce imprinted, bracketed exposures at preset intervals. No price has yet been set for this back.

We found in our field tests that the remarkably light, well shaped camera handled every bit as well as we could have hoped. Once mastered, we could whiz through the control changes to suit our needs. Not too surprisingly, most of our toughest testing was reserved for the autofocus system.

A family picnic at the home of a MODERN technician provided an ideal opportunity to put Maxxum to the test with some of the toughest of subjects: human beings from three years old upwards milling about in fast and grand confusion in every direction imaginable.

The Maxxum responded to both indoor and outdoor scenes with proper exposures and quick, accurate focus. Shots made even in a dimly lit den where children were playing with a computer proved no obstacle for the camera's autofocus system. However, the feisty three year old, running, twisting and turning faster than any broken field runner, proved impossible. The Maxxum's shutter would not release because the autofocus simply couldn't keep up with him—but we did get a few good sharp pictures when we resorted to manual focus.

It was indeed relatively easy to find or create impossible-to-autofocus subjects that would defeat the system, once we detected its weaknesses, but seldom were they subjects you would ordinarily photograph—sparse scribbles on a blackboard, venetian blinds, areas very poorly lit, or with almost no contrast.

To test the autofocus further, we raced a bicycle past in different directions and at various camera-to-subject distances with each of the test lenses. The Maxxum responded well, even when action was coming head on, except when the action was very close. The amount of focus change required at 4 ft. with a 50mm lens (or its equivalent with other focal lengths) was simply too much for the system to cope with if the subject was approaching directly. In all fairness to the Maxxum, it takes a fairly experienced photographer to handle such a focusing situation manually.

In sum, we think the Maxxum will probably provide more sharp pictures for the average photographer than he will be able to get by focusing manually. In terms of present-day autofocus technology, the Maxxum delivers on its promises incredibly well.

Unquestionably, the Maxxum has stolen a massive jump on all other SLR manufacturers in multiple, useable features and autofocus.

At present the Maxxum augments but does not replace the other Minolta cameras in the line. However, should sales indicate overwhelming preference for the Maxxum and its lenses, well... don't be surprised to see Minolta shift completely to the new lens mount.

What hath Minolta next up the Maxxum sleeve? We expect a simpler, less featured, perhaps program-only Maxxum. Later we wouldn't be surprised to see a more advanced professional Maxxum maybe with continuous autofocus to follow action. We hear too that other camera makers are seriously considering adopting the Maxxum lens mount as the possible "standard" for autofocus cameras of the future.

The Maxxum may well be the single most successful SLR ever created. This success undoubtedly will cause competitors to put their own multi-function electronically con-



## PERFORMANCE

| Our Standard                                                                      | as Tested |
|-----------------------------------------------------------------------------------|-----------|
| <b>Focal length:</b> $\pm 5\%$<br>(47.50–52.50mm)                                 | 51.85mm   |
| <b>Aperture:</b> $\pm 5\%$<br>(f/1.33–1.47)                                       | f/1.44    |
| <b>Distortion:</b><br>( $\pm 1.5\%$ )                                             | under 1%  |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0–1.5 stops) | 0.5 stops |

## RESOLUTION

| MAXXUM AF 50mm f/1.4<br>at 1:50 |                  |    |                  |    |
|---------------------------------|------------------|----|------------------|----|
| f/                              | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 1.4                             | Good             | 50 | Excellent        | 45 |
| 2                               | Good             | 56 | Excellent        | 50 |
| 2.8                             | V. Good          | 63 | Excellent        | 56 |
| 4                               | V. Good          | 63 | Excellent        | 56 |
| 5.6                             | Excellent        | 70 | Excellent        | 63 |
| 8                               | Excellent        | 70 | Excellent        | 63 |
| 11                              | Excellent        | 63 | Excellent        | 56 |
| 16                              | Excellent        | 63 | Excellent        | 56 |
| 22                              | V. Good          | 56 | Excellent        | 50 |

## CONTRAST

| MAXXUM AF 50mm f/1.4<br>at 30 lines/mm |               |    |               |    |
|----------------------------------------|---------------|----|---------------|----|
| f/                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 1.4                                    | High          | 50 | High          | 38 |
| 2                                      | High          | 56 | High          | 46 |
| 2.8                                    | High          | 68 | High          | 56 |
| 4                                      | High          | 74 | High          | 64 |
| 5.6                                    | High          | 72 | High          | 61 |
| 8                                      | High          | 66 | High          | 54 |
| 11                                     | High          | 61 | High          | 50 |
| 16                                     | High          | 51 | High          | 49 |
| 22                                     | Medium        | 48 | Medium        | 39 |

trolled autofocus camera plans into high gear.

Minolta has developed all new lenses to work on the Maxxum. Several incorporate low index, anomalous dispersion (AD) glasses to minimize size and weight, and all are designed for maximum focusing efficiency, so that they may be driven by one of the Maxxum's internal motors. Each lens has an internal ROM chip, which, using power supplied by the camera, passes information about focal length and aperture to the Maxxum's computer. We'll be publishing test reports on additional Maxxum lenses in the near future. (August 1985)

**Specifications:** 50mm f/1.4 Maxxum AF, No. 13001979, in Minolta A bayonet mount; accepts 49mm filters, f/1.4–22, 1/2 stops set automatically or manually; min. foc. dist. 1 1/2 ft. (0.45m), built-in lens shade; \$596.

**Practical comments:** Focus from min. to infinity in 120° turn, manual focus very smooth, depth-of-field scale in white, distance scale in window has meters in white, feet in yellow, all have clear large numerals. Lens has comfortable, molded rubber grip, narrow knurled focusing ring. Apertures must be set electronically by camera.

**Field test slides:** Slides were crisp and snappy throughout. By f/2.8 corner sharpness equalled center. Slight color fringing was noticeable in extreme corners at wider apertures. Flare was well controlled throughout. Some light falloff was noticeable at f/1.4 but this was gone by f/2. Overall performance was average for wide aperture normal lens.

**Optical bench analysis** (for optical experts only): On axis, slight overcorrected spherical

aberration mixed with a very slight flare. Flare gone by f/2. Lens near diffraction limit by f/8. Off axis, very slight skew ray flare mixed with a very slight astigmatism. Minimal lateral color. (August 1985)

## MAXXUM 9000: MINOLTA'S PRO MULTI-MODE SLR

### MANUFACTURER'S SPECIFICATIONS:

**Minolta Maxxum 9000 Professional single lens reflex camera. Body No. 19002025. LENS:** 50mm f/1.7 Maxxum AF in Minolta A bayonet mount. **SHUTTER:** Electronically-controlled, vertical travel, focal-plane with duraluminum blades and titanium arms. Speeds from 30 sec. to 1/4000 sec., stepless in P and A modes, full stops in M and S modes, bulb in M mode only. **EXPOSURE SYSTEMS:** Program, aperture and shutter-preferred auto exposure plus manual, center-weighted average or spot metering. Compound silicon photo-diode (SPD) at bottom of mirror box reads light off secondary mirror for ambient light and off film for flash metering.  $\pm 4$  stops exposure compensation, AE lock; EV range 1 to 20 ISO 100. **AUTO-FOCUS:** TTL phase detection by CCD array in bottom of mirror box. EV 2 to 18 ISO 100 with ambient light. **FLASH:** 4-pin dedicated hot shoe, direct off the film autofocus control from ISO/ASA 12-1000 in all exposure modes. 1/250 sec. sync. Contact for autofocus illuminator, providing autofocus aid in low light. **VIEWFINDER:** Fixed eye-level prism with interchangeable screens. Standard screen has central autofocus zone rectangle, spot metering zone circle, full-area focusing. LCD display shows exposure mode, shutter speed, aperture, exposure compensation, and metering type in use. LEDs provide flash ready, and confirmation, focus indication. **OTHER FEATURES:** Automatic DX indexing, 10 sec. electronic self-timer, rubberized contoured body with rubberized grip, film reminder window, eyepiece blind, dioptic adjustment, multiple exposure capability, provision for motor drive, data and program backs. **BATTERIES:** 2AA alkaline batteries provide all power. **PRICE:** \$763 with 50mm f/1.7, \$854 with 50mm f/1.4.

With the introduction of the Maxxum 7000 in January 1985, Minolta, in effect, created a whole new camera category: the fully integrated, autofocus, auto-everything, interchangeable lens SLR. While the other leading camera manufacturers were still scrambling to produce competitive models, Minolta unleashed a second bombshell—the Professional Maxxum 9000—less than 10 months later. While the original Maxxum was aimed at the broadest possible spectrum of amateur photographers, here was the first such camera targeted at serious amateurs and professionals.

Although Minolta has long been one of Japan's top camera producers it has not, until now, concentrated on the professional SLR market. True, the Minolta XK Motor Drive (introduced over a decade ago and still listed in the Minolta catalog) is certainly a rugged, pro caliber camera, but it's also a very expensive, limited production SLR that hasn't

## 35MM Single Lens Reflex

attracted a large following. In bringing out the 9000, Minolta hopes to change all that. Indeed, its designers not only responded to virtually every criticism we made of the original 7000, they have also created one of the most sophisticated, comprehensive, internally complex and startlingly original SLR systems the world has ever seen.

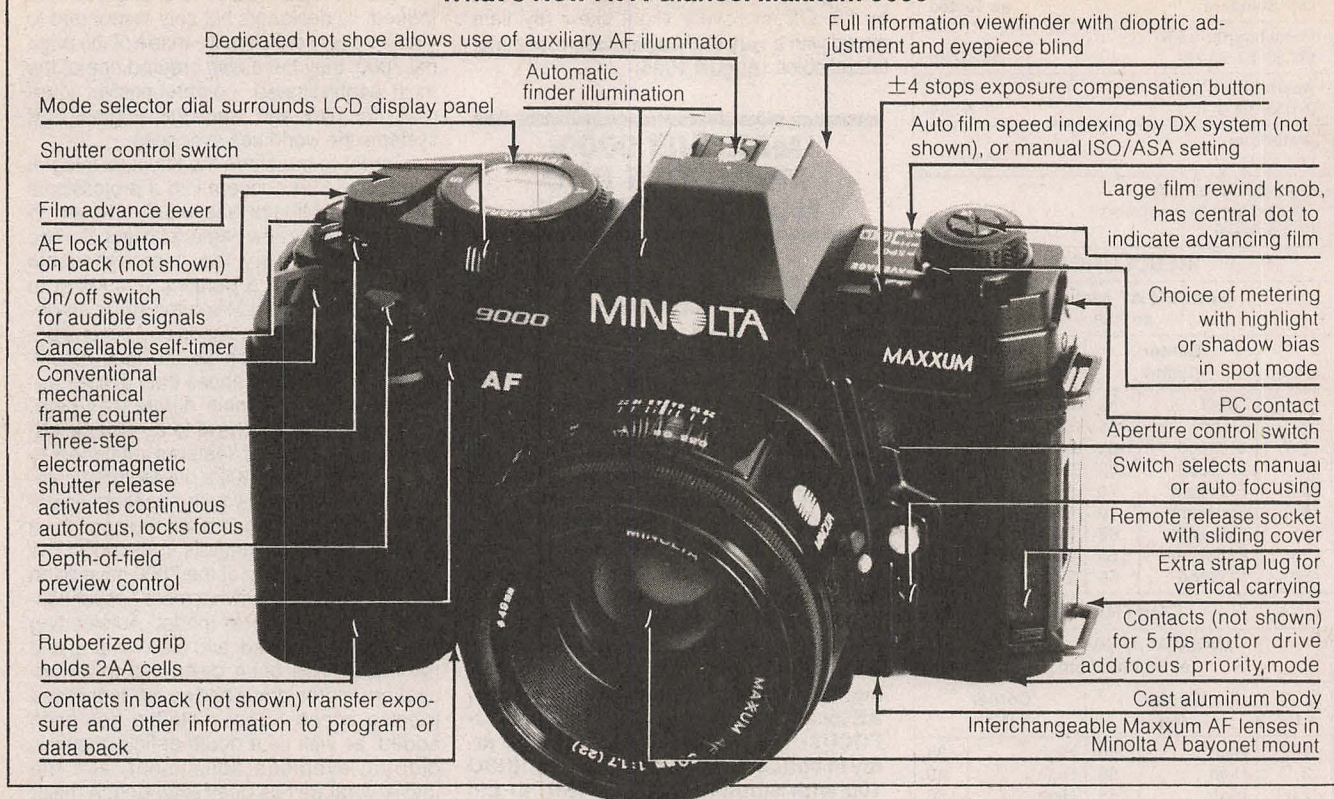
In order to transform the Maxxum integral auto-focus SLR concept into a professional instrument, Minolta has wisely chosen to build an entirely new camera (in fact, the two cameras have very few interchangeable parts—only about 5 percent, according to Minolta). While both Maxxums share an obvious physical resemblance and several basic key features such as the lens mount, there are more differences than similarities. Let's reiterate the main differences here. Most of the changes have to do with the addition or deletion of features designed to make the Maxxum 9000 a pro-featured camera. The hybrid (ABS/metal) construction of the 7000's chassis has been replaced by a solid die-cast alloy chassis in the 9000. The push-button controls of the 7000 have been superseded by somewhat more conventional controls on the Pro model. Autoloading has been abandoned, and auto winding and rewinding have been delegated to an accessory motor drive having an increased framing speed. Spot metering has been added, as well as a depth-of-field preview, dioptic eyepiece adjustment, and the ISO/ASA range has been extended. A major operational change; in auto-focus mode the 9000 focuses continuously on moving subjects and lets you fire at will even if the camera has not attained precise focus. The 7000 only lets you fire when the subject is in focus—unless you switch to manual focus.

There are many additional advanced features to be found in the Maxxum 9000. A 1/4000 sec. shutter providing an X-sync. of 1/250 sec., full metered manual mode, spot metering with highlight and shadow biasing, off-the-film flash control in all modes, a full information viewfinder with interchangeable focusing screens, multiple exposure capability, 4 stops of exposure compensation in 1/2 stops, AE lock and even a PC flash contact, a feature we missed on the 7000. Several features are added or enhanced when using accessories on the 9000. The motor drive MD-90 not only adds auto advance of up to 5 frames per second, but also a focus priority setting (similar to the normal AF mode on the 7000) which will not allow the shutter to trip if the subject is out of focus. Even the array of exposure choices is broadened extensively with the addition of the Program Back Super 90. Along with more traditional data back functions, this amazing accessory adds multiple metering (primarily useful in spot mode), auto exposure bracketing, and it even lets you create your own exposure programs. With the addition of an infrared data receiver, camera settings may even be made by remote control, and the shutter tripped using a Minolta Flashmeter IV.

Is this, then, the perfect advanced amateur/professional camera? Not quite. Several features we feel are highly desirable have not been included. The most significant is the lack of interchangeable prisms offering waist level operation and sports finder options. (There are, however, auxiliary attachments for magnified and right angle viewing.) Granted, the focusing screens are



## What's New At A Glance: Maxxum 9000



easy to change, but for a pro on the job, the fastest, surest way devised so far has been through the top, with prism removed. A mirror lock-up, or pre-firing mechanism would be useful although it's only really necessary in a very small percentage of shooting situations.

For working pros the most serious omission in the Maxxum system is, happily, the easiest to remedy. While Minolta made great strides in introducing a wide variety of lenses with the original Maxxum, the concentration was on zooms, and several lenses which are professional staples have not yet been announced. These include fast wide angles, super-fast teles, portrait lenses (around 85-90mm), and a tele-macro of around 100mm.

Nevertheless, despite these criticisms, the Maxxum 9000 still rates as a formidable camera and a versatile, comprehensive SLR system.

All power for the camera is supplied by a pair of AA alkalines neatly clipped into the smooth, rubberized, right-hand grip. Nicads or carbon-zinc batteries may also be used. Replacing the batteries is literally a snap, though loading the cells into the plastic holder in a hurry takes some practice. If rapid power backup is necessary, additional battery holders are available from Minolta. (Unfortunately, the batteries can't be changed while the motor drive's attached.) Since the 9000 is a fully electronic camera with no mechanical backup systems, we'd recommend always carrying spare batteries. Although we didn't conduct exhaustive power consumption tests, Minolta claims that one pair of AA's will typically power the 9000 for up to 60 36-exposure rolls.

To turn the camera on, slide the switch at the right of the film advance lever forward, revealing the word "on." (If you want audible

signals, slide it farther forward to reveal the "Broadcast" sign denoting audible sounds.) To open the back, pull up on the articulated rewind knob and slide the release button at its front toward the right. Inside the 9000 you'll find a partially light gray slotted take-up spool which is one of the easiest manually loading systems we've found. Below the duraluminum focal-plane shutter are 10 gold contacts for use with data and program backs. Inside the film chamber are six pairs of contacts for reading the DX coded ISO/ASA from the film cartridge. While the back is open, the shutter speed is automatically set to 1/4000 sec. and will remain there until the back is closed and the film is advanced to frame 1. If DX coded film is used, any ISO/ASA from 6-6400 will be set automatically. If non-DX coded film is used, the camera will maintain the last film speed set, or flash ISO 100 (if the batteries have been changed) in both the LCD display atop the body and in the viewfinder to warn you to set it manually. Unless there is a manually set film speed in memory, the shutter will not fire with non-DX film until the ISO/ASA is set—to do this press the ISO button near the rewind knob, while toggling the setting switch in front of the mode setting dial.

Let's take a look through the finder, which Minolta has wisely equipped with built-in dioptric adjustment from -3 to +1 diopter. In the center of the standard full-focusing screen is a small horizontal rectangle outlining the autofocus area. Surrounding this rectangle is a circle approximating the area covered by the 2.7 percent central spot meter.

Like the Maxxum 7000, the 9000 has a full information LCD display below the right half of the viewing area. Indeed, the 9000 has one of the most useful displays we've seen, providing aperture, shutter speed, exposure

mode and compensation indication. It even shows which type of exposure metering pattern is being used. The full finder plus LCD display was almost completely visible to eyeglass wearers, depending on prescription. Finder illumination comes from the window atop the prism, and LED illuminators come on automatically (these LEDs and both LCD displays stay on for 10 sec. after you let go of the electronic release) whenever the overall light falls below EV8.9—useful in most shooting situations. There are times, though, when you may want the readouts illuminated in brighter light levels or, when the light level of the scene you're photographing is much lower than the light illuminating the finder (as when photographing a brightly lit stage from a dark auditorium). A manual finder illuminator switch would prove a welcome addition. For now, the only way to activate the finder illuminating LEDs is to cover the lens or point it away from the bright subject while holding the release lightly. Additionally, the finder provides LEDs for flash ready and confirmation and focus information.

We found the camera well balanced and comfortable to hold with intelligently designed front and rear rubberized grips. The electronic shutter release is smartly placed atop the front grip. The film advance lever is likewise comfortably contoured and it can advance the film (and cock the shutter) with either a single 128 degree stroke or a series of shorter strokes. On the side of the front grip, towards the lens, is a folding plastic tab. Flip it out so that it's pointing toward the lens, and press it halfway down and the lens will stop down to the electronically set aperture for depth-of-field preview. The finder will darken, autofocus will not operate, and the meter symbol in the finder (and the F in the top LCD panel) will flash.



Although you can adjust shutter speeds while stopped down, the aperture cannot be changed. If you change the shutter speed or focal length (with a variable aperture zoom), an incorrect exposure may occur. To avoid this possibility the depth-of-field preview should be released before you take the picture. Press down all the way on this tab, and the system will return to normal, wide open operation. Incidentally, the depth-of-field preview only works if the shutter is cocked. It took us some time to get used to this quirk, but it's unavoidable with the Maxxum's all-electronic aperture determination system.

Electronically, the phase detection autofocus system is virtually identical to that of the Maxxum 7000 and is described in detail in our 7000 report. However, continuous focusing is now the primary autofocus mode and a heavier duty motor is used to drive the lens.

Using the autofocus system optimally takes some practice. The electronic shutter release is actually a three-position switch. Just the slightest touch and the focusing motor within the camera starts to whirr as the lens begins to focus. The system can check and re-adjust focus several times per second, and can track most subjects well, depending, of course, on the subject's speed and distance. A very slight additional pressure on the release locks the focus, so you can recompose without keeping the sharpest point dead center in the picture area. Press the release harder and the shutter will fire. While undoubtedly the most convenient setup, it is perhaps too easy to lock focus accidentally when you want to follow focus. However, you can develop the right touch after shooting a couple of rolls.

The 9000 specification for low-light autofocus capability has been extended. Originally EV3 ( $\frac{1}{6}$  sec., f/1.4 at ISO/ASA 100) for the original Maxxum 7000, both will now get down to a claimed EV2 ( $\frac{1}{4}$  sec. at f/1.4). In our tests we found that the 9000's autofocus system does indeed work at this low light level, but felt that it was sluggish with subjects of normal contrast. It could take up to 3 sec. to find focus (from infinity to 7 ft.), with the 50mm f/1.7 lens. When the illumination was raised to EV3, focusing speed improved markedly—to less than 0.8 sec. At EV4 or greater this was reduced even further to less than 0.4 sec. Of course, at any of these light levels, you'd probably use flash, and the 9000's flash supplies its own autofocus target. More on this later.

Because the speed and accuracy of most autofocus systems are dependent upon light level, subject contrast, subject detail, and even subject color, it is vital to have a manual override system—especially on a pro-level SLR. Flip the switch on the bottom left of the lens mount down, covering the "AF" to reveal an "M," and the focusing shaft is retracted from the lens mount, enabling you to focus the lens manually. As we've said before about the Maxxum lenses, we'd prefer a wider focusing ring, but manual focusing is still pleasantly smooth. In manual focus mode the red arrow LEDs in the finder provide focus assist by indicating the direction to turn the focusing ring. A green circle lights up when you attain correct focus.

The Maxxum 9000 is much more than a good autofocus SLR. It is a comprehensive multi-mode, multi-metering SLR as well. There is a choice of three auto-exposure

| GENERAL PERFORMANCE                                   |                                                                                                                                                                          |                                                     |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| Checkpoints                                           | Our Standard                                                                                                                                                             | As Tested                                           |
| <b>FINDER:</b>                                        |                                                                                                                                                                          |                                                     |
| Apparent viewing distance                             | Between infinity and 20 in. (0.5m)                                                                                                                                       | 39in (1.0m)                                         |
| Apparent distance of shutter-speed and aperture scale | Between 79in (2.0m) and 26in (0.7m)                                                                                                                                      | 39in (1.0m)                                         |
| Apparent distance of LED focusing indicators          | Same as above                                                                                                                                                            | 46in (1.2m)                                         |
| View area compared to film area                       | Vertically and horizontally more than 90%, less than 100%                                                                                                                | Vertical: 94%<br>Horizontal: 93%                    |
| Parallax error compared to film                       | Vertical: 0.7mm<br>Horizontal: 1.3mm                                                                                                                                     | Vertical: 0.25mm (up)<br>Horizontal: 0.05mm (right) |
| Focusing accuracy at maximum aperture                 | Within depth of focus                                                                                                                                                    | No Discrepancy                                      |
| Image magnification                                   | 0.81X $\pm$ .1X                                                                                                                                                          | 0.81X                                               |
| <b>PICTURE SIZE:</b>                                  | 24 $\pm$ 0.6mm x 36 $\pm$ 0.9mm                                                                                                                                          | 24.2mm x 36.3mm                                     |
| <b>SHUTTER:</b>                                       |                                                                                                                                                                          |                                                     |
| Curtain travel evenness                               | $\pm$ 0.33 stop                                                                                                                                                          | 0.05 stop                                           |
| Insulation from sync                                  | More than 7 megohms                                                                                                                                                      | Infinity                                            |
| Sync contact efficiency                               | More than 60%                                                                                                                                                            | 78% (hot shoe)<br>80% (pc)                          |
| Sync delay time                                       | X: within full opening                                                                                                                                                   | Okay                                                |
| Shutter curtain bounce                                | Not allowed                                                                                                                                                              | None                                                |
| Self-timer delay                                      | 7-15 sec.                                                                                                                                                                | 11 sec.                                             |
| <b>CAMERA SIZE:</b>                                   | Body: 5 $\frac{5}{16}$ in. wide 3 $\frac{9}{16}$ in. high, 2 $\frac{5}{16}$ in. deep (144x92x59mm)<br>Lens: 1 $\frac{1}{2}$ in. long, 2 $\frac{1}{2}$ in. dia. (39x65mm) |                                                     |
| <b>WEIGHT:</b>                                        | Body: 1 lb 8 $\frac{1}{16}$ oz (683g) with batteries<br>Lens: 6 $\frac{7}{8}$ oz (196g)                                                                                  |                                                     |

modes; aperture- preferred, shutter-speed preferred, and full programmed automation, plus metered manual. The choice of a center-weighted averaging, or spot metering pattern can be applied in any exposure mode.

To select the exposure mode turn the dial surrounding the top LCD display panel, until your choice of A (for aperture preferred), Program, S (for shutter speed preferred), or Manual, clicks in opposite the arrow pointing to the camera's front. This is far simpler than the push-button method employed on the 7000, and the large diameter dial with an angled, textured edge is more comfortable to turn than most conventional shutter-speed dials. You can change modes easily while looking through the viewfinder. Touch the shutter release—this activating the finder display; now rotate the dial with your index finger (in either direction), and stop when the desired mode indicator appears in the finder LCD panel and the dial clicks into position.

As with the Maxxum 7000, if you select programmed automation, the camera will choose one of three programs, based on the focal length of the lens in use. If you don't

like the camera-selected shutter speed and aperture combination, you may shift the program without changing the exposure. To shift the program, use the laterally movable shutter control tab located just below the set exposure mode. (The aperture setting switch may also be used, but the shutter control tab is more convenient). When the program is shifted, the P mode indicator flashes in the viewfinder.

In shutter-priority or aperture- priority mode, the Maxxum 9000 is almost self-explanatory in operation. When the mode selector dial is turned to A (for aperture-priority AE), either the aperture or shutter control switch can be used to adjust the aperture. An arrow in the LCD display atop the camera points to the set aperture, indicating that it has been manually set, while in the viewfinder, the A mode indicator points to the aperture in use. The camera will not let you select an aperture beyond the range of the lens mounted. To change setting rapidly, just hold the switch.

Shutter-priority AE is operated in a similar manner except that the arrow in the top LCD panel indicates that shutter speeds will now be manually selected, and the S mode indi-



## 35MM Single Lens Reflex

cator in the viewfinder points appropriately towards the shutter speed in use. Any shutter speed may be selected, but if the resultant aperture is beyond the range of the lens, either the minimum (for underexposure) or maximum (for overexposure) aperture will flash in both LCD displays to warn you of improper exposure.

Auto exposure doesn't stop here. Up to 4 stops of exposure compensation, in  $\frac{1}{2}$  stops, may be keyed in by pressing the "+/-" exposure adjustment button on the top, front left side of the camera, while using the shutter control switch to set the precise amount. You can see how much compensation you're setting by looking at the top LCD panel, or through the viewfinder while holding the exposure adjustment button. After you let go of this button, the top panel will show either + or - to show which way you've set the compensation. In the viewfinder LCD, however, the Maxxum shows the amount and type of compensation in addition to all the other information for each mode. Once you become accustomed to the location of the "+/-" button, you'll find it a simple matter to set AE compensation without taking your eye from the finder.

To attain proper auto exposure with a subject not directly in the center of the viewfinder, first aim at the subject. Then you press the AE lock button in with your thumb. The original exposure will then be held while you recompose the picture, keeping the button depressed. By turning the metering selector surrounding the rewind knob to "SPOT," you can use all the foregoing modes with spot metering measured within the viewfinder circle. This amounts to 2.7 percent of the picture area. Spot metering is especially useful when combined with the AE lock. Two other settings, "H" and "S," will shift the exposure either toward a highlight or shadow detail based on the spot readings when the AE lock is pressed. Even multiple spot metering is possible with the Maxxum 9000. With the use of an accessory Program Back, up to eight readings can be stored and the resulting data can be averaged, centered, or shifted for highlight or shadow readings. On an advanced amateur or professional model camera, metered manual mode is vital. Here the Professional Maxxum uses its digital wizardry not only to indicate the proper exposure, but also to tell you how far off you are (from +6.5 to -6.5 stops, in  $\frac{1}{2}$  stops) from the correct exposure. If you exceed the "+/-" 6.5 stop range, either the + or - 6.5 blinks in warning. This allows easy bracketing. In manual mode use the shutter control switch below the mode selector to change shutter speeds. Push it left for longer exposures, and right for faster-shutter speeds. Shutter speeds can be set manually in full stops only. For  $\frac{1}{2}$  stop adjustment (or to select a different aperture) slide the aperture control switch on the left top side of the lens mount.

Of course, you can have average or spot metering in manual mode. With the metering selector set for highlight or shadow, the meter will give the "normal" spot reading until you press the AE lock button. You can adjust the shutter speed or aperture while holding this button, and by holding in either control settings can be changed quickly.

A few additional features round out the basic Maxxum 9000 package. There is a cancellable 10 sec. self-timer on the 9000.

The eyepiece blind used during long exposures or remote control operation is a valuable asset. Multiple exposure provision is likewise provided; it's a bit clumsy for one-hand operation. A PC contact (non-existent on the 7000) is included on the left side of the camera, a welcome addition, although a threaded one would be even better as it would prevent the PC from accidentally coming loose. On the right front of the body is a terminal for a remote release, with a wonderful cover that slides into the body for storage; no little plastic cap to lose! With few details overlooked, Minolta intelligently included three neckstrap lugs, allowing the camera to hang horizontally or vertically.

Incredible as it may seem thus far, there's a lot more to the Maxxum 9000 than a body and lens. Adding its motor drive adds an autofocus mode; mounting the program back adds a whole new array of exposure modes and capabilities. Even the Maxxum flash units give more than mere illumination to the camera. Let's examine these key accessories one at a time.

One of the most important accessories for a camera of this class is a motor drive. The MD-90 Motor drive delivers up to 5 frames per second film advance, and can rewind a 36 exposure roll in 8 sec. While the actual advance speed is dependant on the shutter speed in use, the MD-90 can be set for three different maximum rates, "H" for 5 fps., "M" for 3 fps., and "L" for up to 2 fps. Setting the selector dial to "S" sets the motor for single frame advance.

Above the "S" setting is "F.P." for focus priority. When set to this mode (with the camera set to autofocus), the shutter will release only if the subject is in focus. In "F.P.", frame advance is up to 4 fps. This mode is useful for shooting action sequences, since the lens will refocus between exposures.

The motor can be switched to the "OFF" position, allowing manual film advance, but there is no way to rewind film manually with the motor drive in place. After auto-rewind the film leader remains out of the 35mm cassette, convenient for use with Polachrome slide film, or when changing film mid-roll.

The MD-90 can be combined with a choice of power supplies all of which must be purchased separately. The BP-90M with 12AA Alkaline batteries should provide power for up to 50 rolls of 36 exp. film. We operated the motor extensively with the rechargeable Nicad pack, NP-90M, which is about  $\frac{1}{2}$  in. slimmer, and, according to specifications, can supply power for up to 35 rolls. As we would with any Nicad battery, we recharged after each use, and were never without power. The Nicad pack must be used to get the maximum 5 fps. from the motor. Each power pack has its own auxiliary shutter release that functions identically to the camera's own 3-position switch. To prevent accidental firing, an on/off switch disables the auxiliary release.

The full capability of the Maxxum 9000 cannot be realized until you add the Program Back Super 90. In addition to the more traditional data imprinting and intervalometer tasks, this accessory lets you create your own exposure programs, (up to three at a time), store multiple metering readings, and even shoot automatic bracketing sequences, (best when used with MD-90). Almost any combination of functions can be used simultaneously, and data imprinting can include shutter speed and aperture in-

formation.

With some practice you can learn how to use the program back even though it comes with a clear, well illustrated, 55-page instruction manual. In any of the exposure modes, all settings are made by using the controls on the program back. This makes it somewhat complicated, but once you master all its capabilities you'll find it's well worth it. When you write your own program(s), they will not change automatically with focal length, but you can change programs at any time by pressing the button labeled "MODE" on the back. The back provides programmed AE, shutter-priority AE, aperture-priority AE, and even metered manual control, but can't be used with any TTL flash functions.

Of all program back functions, multi-metering is perhaps the most natural extension of the 9000's basic operations. By storing up to eight readings, the auto exposure system can set the shutter speed and aperture combination to the mathematical average of the readings. You can also set the back to adjust exposure thus producing a proper highlight or shadow from the most extreme point. You can also choose an exposure centered in the range of readings. During use, the LCD display on the back shows you graphically each reading, and its relation to film latitude (base on slide film).

The most unusual mode of the program back is auto-bracketing where you can select a range of exposure deviation from the metered value and program the camera to shoot a sequence of up to nine frames with exposure changes of  $\frac{1}{4}$ ,  $\frac{1}{2}$ , 1, or 2 stops.

The program back is approximately  $\frac{1}{2}$ -in. thick and has its own channeled thumb guide. Although not rubberized like the grip on the standard back, this guides your thumb towards the AE lock button. We found that it was somewhat difficult to see the entire viewfinder with eyeglasses on, but we could work around this, in many cases, by taking our glasses off and using the dioptic adjustment. The back, powered by six MS-76-type button cells, in two separate compartments features a graphic low battery signal that shows which compartment contains the weak batteries.

Off-the-film measurement, dedicated flash control is available in all of the 9000's exposure modes. The Maxxum flash 2800AF works in full dedication with the 9000 (this flash is fully described in our report on the 7000) but it is with the newer Maxxum 4000AF flash that the 9000 performs best. As when using the 2800AF, the 4000AF will provide flash ready and flash confirmation signals in the viewfinder, and both units have a built-in AF illuminator to allow autofocus in total darkness (up to 23 ft. with 4000AF, 16 ft. with 2800AF), but the 4000AF does more. When set for auto zoom, the flash head will automatically adjust for coverage for the focal length in use, from 28-70mm. With a zoom lens in place, the head adjusts automatically from settings for 28mm, 35mm, 50mm and 70mm as you zoom. The head can tilt upwards to 90 degrees and can swivel 180 degrees side to side.

A panel on the back of the flash displays the flash range digitally in either feet or meters based on the actual aperture in use, and film speed. The 4000AF is powered by 4AA Alkaline or Nicad batteries. The guide number (ISO/ASA 100) ranges from 28-45 in



meters (92-148 in feet), depending on coverage.

For off-camera use, the control grip CG-100 set is used. The grip set includes the control grip, a camera bracket, 5 meter extension cable, and an AF illuminator. The AF illuminator must be used in the dedicated hot shoe atop the prism with the flash mounted on the grip. Batteries in the control grip supply the flash with additional power for faster recycling times. Like the other Maxxum accessories we've discussed, the control grip adds new capability to the Maxxum 9000. If a second Maxxum dedicated flash is used in the hot shoe (instead of the AF illuminator) the control grip can be switched to provide a balanced 2:1 flash ratio in all exposure modes.

Additional accessories include focusing screens, remote release cables, and a 100-exp. bulk back, complete with eyepiece extension and a built-in super back 90, making the Maxxum 9000 a system adaptable for almost any shooting situation. With its array of modes and options, plus over 14 lenses already available (and more on the way) the Maxxum 9000 should give Minolta a strong foothold in the advanced amateur and professional markets.

In the field the Maxxum 9000 performed extremely well, delivering sharp, properly exposed, pictures in almost all situations. For successful autofocus of fast moving subjects such as race cars or motorcycles moving across the frame, we found it best to pan with the action, keeping the subject centered. If not possible, manual focus was called for. When our subject came at us head on, the AF system would refocus, unlike the 7000. And it didn't prevent us from firing, as the 7000 would have, just because we didn't have a green focus confirmation.

We were pleased with the speed and sureness of focus that resulted each time we heard the whirring of the AF motor, and the signal. It seemed almost as if the camera knew just how far to turn the lens the moment we took aim. The trickiest part was learning to use the three-position shutter release. Slight pressure provided continuous focus but almost any tiny additional pressure on the switch would lock focus. Some testers would have preferred a separate focus lock, to prevent accidentally holding focus, but most adjusted to the multi-level release switch after a few rolls.

We seldom had to take an eye from the finder as we worked. We were free to concentrate on composition and timing, since both the mode and metering control positions have detents, and their current settings are displayed by changes in the finder LCD panel. Even when we forgot that the metering selector was set to H instead of spot, spot mode would operate normally, since the 9000's AE lock button must be pressed to actually bias the exposure.

Holding the camera by the rubberized grip, our fingers rested on the proper controls whenever an adjustment was needed, or we wanted to change modes.

With motor drive attached, the camera felt as solid as any pro camera/motor combination we've used, and at a full 5 fps. it rates among the fastest. We didn't use focus priority mode as much as we first thought we might, but somehow it was comforting to know that it was there for moderate speed action sequences when needed. We've grown so accustomed to TTL flash control

that few of us ever shoot flash otherwise (except with studio units). Flash pictures were well exposed, and although we found the abundance of information on the back of 4000AF clear and useful, it wasn't necessary, as the flash made most adjustments itself.

The Program Back Super 90 is aptly named. When our slides came back from the lab we immediately wanted to see our exposure setting printed along the frame-line but we couldn't find any trace of the data imprint until the slide was removed from its mount. We have mixed feelings about this. Many memo back users object to date being printed on the visible picture area, but we are happy that data can be imprinted under the slide mount without affecting the picture area. Still, you must nearly destroy the slide mount, in some cases, to read the printed data. Auto-bracketing also appealed to us. It was so easy with the motor drive on high. But watch your brackets. We tended to over-bracket and overshoot which can lead to skyrocketing film and processing costs.

The Maxxum 9000 may not be for every advanced amateur or pro, but its versatility and advanced array of features, especially continuous focus, will make it an excellent choice for many. Be aware that although it is one of the lowest priced "pro" models, few will want to pass up the motor drive, and many will want to experiment with the Program back, which drives the cost up substantially. (May 1986)

## 50mm f/1.7 MAXXUM AF

**Specifications:** 50mm f/1.7 Maxxum AF No. 16005543; in Minolta A bayonet mount, accepts 49mm filters; f/1.7 to f/22 set electronically by camera; min. foc. dist. 1 ft 6 in. (045.); built-in retractable lens shade; 2<sup>9</sup>/<sub>16</sub> in., 1 1/2 in. diam., 6 7/8 oz. (195) g. \$93.

**Practical comments:** Excellent satin-black finish, with textured rubber grip, narrow, 1/8 in. ribbed focusing ring. Distance scales visible in window; clear, legible with feet (yellow), meters (white) plus depth-of-field and IR focus mark.

**Field test slides:** Transparencies were crisp, snappy and well exposed with detail well rendered at all apertures. Just noticeable softness at corners of field at wide apertures, but center and edge details equal by f/2.8. Flare was well controlled.

**Optical bench analysis** (for optical experts only): On axis, very slight undercorrected spherical aberration mixed with a very slight red flare, both gone by f/4. Image was near diffraction limit by f/8. Off axis, very slight skew-ray flare mixed with very slight astigmatism to f/8. Slight lateral color present.

## PERFORMANCE

| Our Standard                                                                      | as Tested |
|-----------------------------------------------------------------------------------|-----------|
| <b>Focal length:</b> ±5%<br>(47.50-52.50mm)                                       | 52.16mm   |
| <b>Aperture:</b> ±5%<br>(f/1.62-1.78)                                             | f/1.76    |
| <b>Distortion:</b><br>(±1.5%)                                                     | under 1%  |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.7 stops |

## 35MM Single Lens Reflex

### RESOLUTION

| MAXXUM AF 50mm f/1.7<br>at 1:49 |                      |                      |              |
|---------------------------------|----------------------|----------------------|--------------|
| f/                              | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |              |
| 1.7                             | Good                 | 49                   | Excellent 44 |
| 2.8                             | Good                 | 55                   | Excellent 49 |
| 4                               | Good                 | 62                   | V. Good 55   |
| 5.6                             | V. Good              | 69                   | Excellent 62 |
| 8                               | V. Good              | 69                   | Excellent 62 |
| 11                              | V. Good              | 62                   | Excellent 55 |
| 16                              | V. Good              | 62                   | Excellent 55 |
| 22                              | Good                 | 55                   | V. Good 49   |

### CONTRAST

| MAXXUM AF 50mm f/1.7<br>at 30 lines/mm |            |            |           |
|----------------------------------------|------------|------------|-----------|
| f/                                     | Center (%) | Corner (%) |           |
| 1.7                                    | Medium     | 39         | Medium 30 |
| 2.8                                    | Medium     | 44         | Medium 36 |
| 4                                      | High       | 61         | High 50   |
| 5.6                                    | High       | 65         | High 55   |
| 8                                      | High       | 66         | High 56   |
| 11                                     | High       | 59         | High 49   |
| 16                                     | High       | 51         | High 42   |
| 22                                     | Medium     | 40         | Low 32    |

## MINOLTA MAXXUM 5000: THE BASIC AF SLR?

**MANUFACTURER'S SPECIFICATIONS:** Minolta Maxxum 5000 Standard, single lens reflex camera. Body No.11104901. **LENS:** 50mm f/1.7 Maxxum AF in Minolta A bayonet mount. **SHUTTER:** Electronically controlled, vertical traverse, focal plane with duraluminum blades and titanium arms. Speeds from 4 sec. to 1/2000 sec., stepless in P mode. **EXPOSURE SYSTEMS:** Program AE and manual, use center-weighted average metering. Silicon photo diode (SPD) at bottom of mirror box reads light off secondary mirror for ambient and off-film for flash metering. +2 stops backlight compensation; EV range -1 to 20 at ISO/ASA 100. **AUTOFOCUS:** TTL phase detection by CCD array in bottom of mirror box. EV 2 to 19 ISO/ASA 100 with ambient light. **FLASH:** 4 pin dedicated hot shoe provides direct OTF autofocus from ISO/ASA 25-1000. Contact for autofocus illuminator, providing autofocus aid in low light. 1/100 sec. sync. **VIEWFINDER:** Fixed eye-level prism with central autofocus zone rectangle. LCD display shows mode, shutter speed, and aperture. LEDs provide flash ready and confirmation, focus indication. **OTHER FEATURES:** Automatic DX indexing, 10 sec. self-timer, rubberized contoured body, film reminder window, built-in winder, power rewind, provision for data and program backs. **BATTERIES:** 4AA alkaline batteries provide all power. **PRICE:** \$560 with 50mm f/1.7, \$660X with 50mm f/1.4.

When the Maxxum 7000 made its debut in March of '85 it was an instant success that has proven to be much more than a passing fad. Indeed, it was the first autofocus SLR to perform competently enough to capture the public's fancy and to send other camera makers scurrying back to their drawing boards. Now that two successful Minolta Maxxums and one autofocus Nikon have



## 35MM Single Lens Reflex

proven beyond a shadow of a doubt that people really are interested in buying AF SLRs, Minolta has taken on the formidable task of producing a lower cost, simpler-to-use model. The result is the Standard Maxxum 5000 (see "What's What," MODERN PHOTOGRAPHY, May, 1986, page 28).

Gone are the 7000's multiple push-button mode controls, choices of automation, and even the "panic button" needed to set the 7000 back to its basic program mode. The styling of the prism and body contours have also been slightly altered, but what remains provides an ergonomic and effective camera that almost anyone can learn to use in a matter of minutes.

In terms of function, much of the 5000 is taken from the 7000. (Internally, the two are so similar that we've opted not to run our usual disassembly photos). The 5000's three exposure programs are identical to those found in the 7000 (see "Modern Tests," August, 1985, page 56), as is the way they switch automatically as you zoom or change focal length. But, in pursuit of simplicity and lower cost, the 5000 lacks such overrides as program shift, autoexposure compensation and AE lock, found on the more expensive models. Autofocus on the Maxxum 5000 is virtually identical to that of the current 7000. As with the 7000, in autofocus mode, the camera will not take a picture unless correct focus has been achieved, as confirmed by a green LED in the finder.

Without further ado, let's put the Maxxum 5000 through its paces. As with its older brother, four AAA batteries are nestled tightly within the comfortable rubberized grip. You can tighten the knurled and slotted grip attaching screw with your fingers; a coin is needed to remove it only if it's on too tight. A built-in lithium battery keeps ISO/ASA and frame number in memory while you change batteries.

To open the back, press the light gray dot on the camera's left, and slide the bar down. The ABS plastic back will pop open revealing the 6 pairs of DX film speed contacts, 4 data back contacts below the aluminum vertical traveling shutter and an autoloading system identical to that of the 7000. It's one of the most straightforward autoloading systems we've seen. Just drop in the film cartridge, pull the film leader out to the orange mark below the take-up spool and close the back. Turn the camera on by sliding the switch forward to "on" (further forward if you want audible warnings), and the camera will advance the film to the first frame. The DX-set ISO/ASA flashes briefly, (for non-DX film, the previously set ISO/ASA will flash), then an outline of a film cartridge will appear in the top LCD display along with the frame number "1," to show that the film is loaded properly.

The LCD panel displays the word "PROGRAM," telling you that the exposure will be selected according to one of the three on-

board exposure programs (see chart above). This is the normal operating condition for this entry level SLR, and the choice of programs is made by the camera only, based on the focal length of the lens in use.

As with the other Maxxum models, this information is transferred from the lens via five electrical contacts in the Maxxum's bayonet lens mount. Mount the lens on the Maxxum body by aligning the red dot on the back of the lens with the dot on the lens mounting flange, then twist clockwise 45° until the lens clicks into place. The red dot now faces the lens release button; you press to reverse the process and remove the lens. Just below this button is the auto/manual focus selector. Let's leave it up, at the "AF" setting for autofocus.

The top-mounted LCD panel gives no indication of the actual f/stop and shutter speed, but a peek through the viewfinder will show you both. As with the other Maxxum cameras, the LCD display within the viewfinder is automatically illuminated when the ambient light level falls below EV 9 (1/100 sec. at f/2.4).

Press lightly on the shutter release, and the LCD panel shows a "P" for programmed mode, a shutter speed from 4 to 1/2000 sec. and an aperture (in 1/2 stop increments). If overexposure were to result (beyond 1/2000 sec. at f/22), the information in the display will flash. If the light falls to a level requiring an exposure below 4 sec. at f/1.7 (ISO/ASA 100), the panel flashes with a diamond between the speed and aperture, warning of underexposure. When the batteries are weak, a picture of a battery flashes to the right of the f/stop display. (The same symbol appears in the outside LCD panel.) Although we'd suggest that you change the batteries as soon as possible, you should still have enough power to finish a 36 exposure roll. To the left of this panel are LEDs that give focus and flash status.

Now you're ready to take pictures. Hold the Maxxum 5000 by the comfortable, right-hand, rubberized grip and your index finger falls naturally over the shutter release. Look through the finder, place your subject within the rectangular target in the center of the matte focusing screen, press lightly on the shutter release, and in less than 1 sec. the whirring motor within the camera body will drive the lens to a sharp focus, a green LED circle light indicating proper focus. Press a bit harder on the shutter release and the shutter fires using the shutter speed selected by the camera's program, displayed in the finder LCD panel. Like the Maxxum 7000, the shutter release of the 5000 is a bit touchy. Pressing it just far enough to focus and check the exposure setting without accidentally firing the shutter takes a bit of practice although much of the time you'll have no need to separate these functions, except to use the focus lock feature (which lets you hold focus and recompose with the subject located outside of the autofocus target).

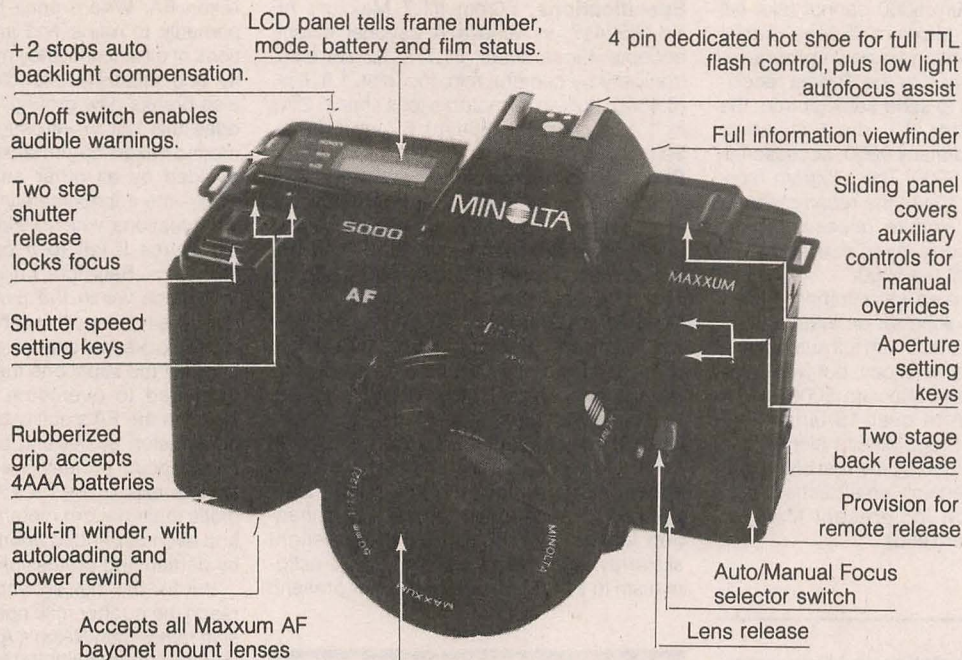
If the Maxxum is unable to reach focus due to lack of contrast, extremely low light (below EV 2), or an unusual lack of subject detail (all situations that are difficult to handle for any focusing system, whether AF or manual) two red LED arrows flash, the lens sets itself to infinity focus, and the shutter will not release unless you flip the AF/Manual focus switch down to manual focus position. The manual focus ring on many Minolta A-

### GENERAL PERFORMANCE

| Checkpoints                                           | Our Standard                                                                                                                        | As Tested                                          |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>FINDER:</b>                                        |                                                                                                                                     |                                                    |
| Apparent viewing distance                             | Between infinity and 20 in. (0.5m)                                                                                                  | 39 in. (1.0m)                                      |
| Apparent distance of shutter-speed and aperture scale | Between 79 in. (2.0m) and 26 in. (0.7m)                                                                                             | 39 in. (1.0m)                                      |
| Apparent distance of LED focusing indicators          | Same as above                                                                                                                       | 46 in. (1.2m)                                      |
| View area compared to film area                       | Vertically and horizontally more than 90%, less than 100%                                                                           | Vertical: 93%<br>Horizontal: 94%                   |
| Parallax error compared to film                       | Vertical: 0.9mm<br>Horizontal: 1.01mm                                                                                               | Vertical: 0.05mm (up)<br>Horizontal: 0.5mm (right) |
| Focusing accuracy at maximum aperture                 | Within depth of focus                                                                                                               | No discrepancy                                     |
| Image magnification                                   | 0.85X ± .1X                                                                                                                         | 0.86X                                              |
| <b>PICTURE SIZE:</b>                                  | 24 ± 0.6mm X<br>36 ± 0.9mm                                                                                                          | 24.3mm x 36.3mm                                    |
| <b>SHUTTER:</b>                                       |                                                                                                                                     |                                                    |
| Curtain travel evenness                               | ± 0.33 stop                                                                                                                         | -0.06 stop                                         |
| Insulation from sync                                  | More than 7 megohms                                                                                                                 | Infinity                                           |
| Sync contact efficiency                               | More than 60%                                                                                                                       | 82% (hotshoe)                                      |
| Sync delay time                                       | X: within full opening                                                                                                              | Okay                                               |
| Shutter curtain bounce                                | Not allowed                                                                                                                         | None                                               |
| Self-timer delay                                      | 7-15 sec.                                                                                                                           | 10 seconds                                         |
| <b>CAMERA NOISE:</b>                                  | 65 dB(a), very quiet for a motorized autofocus                                                                                      |                                                    |
| <b>CAMERA SIZE:</b>                                   | Body: 5 1/16 in. wide x 3 5/8 in. high x 2 5/16 in. deep (146 x 92 x 60mm)<br>Lens: 1 1/2 in. long, 2 9/16 in. diameter (39 x 65mm) |                                                    |
| <b>WEIGHT:</b>                                        | Body: 1 lb. 4 7/8 oz. (592g) with batteries<br>Lens: 6 7/16 oz. (183g)                                                              |                                                    |



## What's New at a Glance: Minolta Maxxum 5000



series lenses is a bit narrow, but turns freely and easily. The focus information LEDs in the viewfinder still work to give you focus assist (telling you which way to turn the lens), and confirmation. We won't go into great detail about how the Maxxum AF system works since we've covered it in great detail in our previous Maxxum test reports. (Send a self-addressed stamped envelope to Readers Service Editor, MODERN PHOTOGRAPHY, 825 7th Avenue, New York, NY 10019). To recap, we found it to be swift, accurate, and repeatable under most picture taking conditions, and well within Minolta's published specifications.

So far we've described the 5000 as one of the world's most sophisticated point-and-shoot cameras on the market. Like many of the best point-and-shoot cameras, the 5000 has a few features that let you override its automation when the situation warrants it. Replacing the AE (autoexposure) lock button found on the Maxxum 7000 and 9000 is a button labeled "BLC" for back-light compensation. If your subject is strongly back-lit as on a sunny beach, or indoors standing in front of a brightly lit window, press the BLC button on the camera's back with your thumb and hold it in as you shoot, and the exposure will open up two stops. That's enough to correct the backlit silhouette in most cases.

To see why the Maxxum 5000 is unlike any other point-and-shoot camera, slide the panel located to the left of the pentaprism to unveil the controls for three seldom needed switches. The top left switch, labeled "ISO," allows you to manually change the ISO/ASA setting or to set it manually for non-DX film. Press this button and the current ISO/ASA is displayed in the LCD panel on the camera's top, right. Hold and press either of the two soft, rubberized up/down arrow keys, located just behind the shutter release to adjust

the ISO/ASA setting.

Just below the ISO button is a button with a clock symbol, which activates the 10 sec. self-timer. Press this button and the same symbol appears in the main LCD display. Now press the shutter release and "10" will appear, then will digitally count down to 0 as the shutter fires. To cancel the self-timer press the button again or close the cover. There is no flashing LED on the camera's front to warn you when the shutter's about to fire, but if the audible warnings are turned on, the camera will beep twice per second until there are 2 sec. left, then continuously for 1 sec. just before the shutter fires.

The third switch, normally hidden by the sliding cover, lets you take full manual control of the exposure settings. Press the switch labeled "P/M" and the Maxxum 5000 switches from full programmed AE to metered manual operation. (To return to programmed AE, press the button again or just close the cover). In metered manual mode an "M" appears in both LCD displays but it's the finder display that tells the full story. Press either of the two arrow keys behind the shutter release, and the shutter speed will change in full stops. Press either of the similar pair of keys on the left side of the lens mount to change the aperture in  $\frac{1}{2}$  stops. In the finder LCD an arrow will appear between the shutter release, and the shutter speed will change in full stops. Press either of the similar pair of keys on the left side of the lens mount to change the aperture in  $\frac{1}{2}$  stops. In the finder LCD an arrow will appear between the shutter speed and f/stop indications. If it points up, overexposure will result; if down your picture will be underexposed. If both arrows light simultaneously, you've set the correct metered exposure.

When you close the panel cover, the camera will automatically revert to program mode, and cancel the self-timer if engaged.

Only manually set ISO/ASAs will remain unaffected. The ISO/ASA will stay until either changed manually, or a new roll of DX coded film is loaded, a virtually foolproof system.

When you get to the end of the roll, the LCD panel will flash. Film rewinding is also automatic, although you must start it manually. Push in the "R" button on the camera's back, then slide the gray lever to the left, and the camera will rewind the film completely back into the cassette. A 36 exposure roll will rewind in less than 30 seconds.

Like the other members of the Maxxum family, the 5000 is part of a much larger system. All Maxxum flashes will work on the 5000, even providing an infrared target for low light autofocus. However, since the 5000 can also be considered a lower cost entry level camera (certainly in comparison with the other Maxxums), Minolta has taken this opportunity to introduce a compact, simple, less expensive (\$94) flash, the Maxxum 1800AF. This flash can be powered by a long-life lithium battery pack for a claimed 5 years of average use, or by four 1.5v AAA batteries.

Flash control is totally automatic by the camera's off-the-film measurement system, and logically, for an entry level system, the flash has no manual control beyond a simple on/off switch. When the flash is ready a red lightning bolt blinks in the finder and the shutter speed is automatically set to  $\frac{1}{100}$  sec. for sync. Take the picture, and the red lightning bolt will flash rapidly if there was enough light for proper exposure. If you try to take a picture before the ready light flashes, the camera will set the shutter speed and aperture according to the program, which may result in too slow a shutter speed for many handheld shots. The 1800AF has a guide number of 59 (ft.), and can provide automatic fill flash as well as au-



## 35MM Single Lens Reflex

tofocus assist for up to 15 ft. ISO/ASA 100). However, to help keep costs down and operation simple, no provision has been made for using off-camera flash.

While the Maxxum 5000 cannot take full advantage of the Maxxum "Super" backs (that provide for writing your own programs, auto-bracketing, etc.), or the IR data receiver (that allows you to send settings from the Minolta Flashmeter IV), most all other Maxxum 7000, and many 9000, accessories will work with the 5000. The program back 70 and data back 70 are the recommended data backs. The remote release cables, wireless control, and eyepiece adaptors from the 7000 will fit the 5000.

Has Minolta created yet another masterpiece? If you're looking for an interchangeable lens autofocus SLR with full automation, easy to understand functions, but with some manual override, the Maxxum 5000 will be hard to ignore. With over 15 lenses announced thus far (from Minolta alone), and the versatility provided by the rest of the system, the 5000 is certainly an attractive "second body" option for present Maxxum owners. (November 1986)

### Performance, Resolution and Contrast results for 50mm f/1.7 Maxxum (column 2)

#### PERFORMANCE

| Our Standard                                                                       | As Tested      |
|------------------------------------------------------------------------------------|----------------|
| <b>Focal length:</b> $\pm 5\%$<br>(47.50-52.50mm)                                  | 50.33mm        |
| <b>Aperture:</b> $\pm 5\%$<br>(f/1.62-1.78)                                        | f/1.70         |
| <b>Distortion:</b><br>( $\pm 1.5\%$ )                                              | 0.23% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>(0-1.5 stops) | 0.4 stops      |

#### RESOLUTION

##### MAXXUM 50mm f/1.7 at 1:50

| f/  | Center (l/mm) | Corner (l/mm) |              |
|-----|---------------|---------------|--------------|
| 1.7 | Excellent     | 56            | Excellent 45 |
| 2.8 | Excellent     | 63            | Excellent 50 |
| 4   | Excellent     | 70            | V. Good 50   |
| 5.6 | Excellent     | 70            | Excellent 56 |
| 8   | Excellent     | 80            | Excellent 63 |
| 11  | Excellent     | 70            | Excellent 56 |
| 16  | Excellent     | 63            | Excellent 50 |
| 22  | V. Good       | 56            | V. Good 45   |

#### CONTRAST

##### MAXXUM 50mm f/1.7 at 30 lines/mm

| f/  | Center (%) | Corner (%) |           |
|-----|------------|------------|-----------|
| 1.7 | Medium     | 39         | Medium 32 |
| 2.8 | Medium     | 43         | High 37   |
| 4   | High       | 61         | High 50   |
| 5.6 | High       | 64         | High 54   |
| 8   | High       | 66         | High 56   |
| 11  | High       | 58         | High 49   |
| 16  | High       | 52         | High 41   |
| 22  | Medium     | 41         | Medium 33 |

## 50mm f/1.7 MAXXUM AF

**Specifications:** 50mm f/1.7 Maxxum AF No.1652417; in Minolta A bayonet mount, accepts 49mm filters; f/1.7 to 22 set electronically by camera; min. foc. dist. 1 ft. 6 in. (0.45M); built-in retractable lens shade; 2 $\frac{9}{16}$  in. 1 $\frac{1}{2}$  in. diam. (66x38mm), 6 $\frac{7}{8}$  oz. (195 g). \$93.

**Practical comments:** Excellent satin-black finish, with textured rubber grip, narrow 1.8 in. focusing ring. Distance scales clearly visible in window with feet in yellow and meters in white. Depth-of-field scale plus IR focus mark on window.

**Field test slides:** All transparencies were well exposed, crisp and snappy with a hint of softness near the corners wide open. Corner sharpness equal to center by f/2.8. Flare well controlled throughout.

**Optical bench analysis** (for optical experts only): On axis, very slight under-corrected spherical aberration with very slight axial color, both gone by f/4. Image was diffraction limited by f/11. Off axis, very slight skew-ray flare mixed with very slight astigmatism to f/11. Minimal lateral color present.

## NIKON FA: MULTI-MODE PLUS AUTO MULTI-PATTERN METERING

**MANUFACTURER'S SPECIFICATIONS:** Nikon FA 35mm single lens reflex camera. Body No. 5015183. LENS: 50mm f/1.4 Nikkor in interchangeable AI-S bayonet mount, No. 5425677, apertures to f/16, focusing to 18 in., accepts 52mm accessories. SHUTTER: Electronically-timed Nikon-Copal honeycomb titanium-blade focal plane with speeds from 1 sec to 1/4000 sec. plus B, X sync. to 1/250 sec., mechanical self-timer. VIEWING: Non-interchangeable eye-level prism with split-image rangefinder, micropism collar, full-area focusing, interchangeable focusing screen. OTHER FEATURES: 3-volt battery-powered silicon photo-diode circuit. Segmented diodes on either side of eyepiece read either automatic multi-pattern or center-weighted pattern from finder screen, ASA 12-3200, separate silicon photo-diode in mirror chamber measures light from film during exposure for TTL flash auto exposure, dual program auto exposure plus shutter speed, aperture-preferred auto exposure and metered manual exposure modes. LCD finder display, aperture direct readout, shutter speed window, low, high, incorrect auto-setting, auto-exposure compensation, flash ready and O.K. signals in finder, multiple exposure, TTL flash provisions, removable finger grip, locking release and meter turn-on button, depth-of-field preview lever, built-in eyepiece blind, film box reminder slot, fast speed setting to frame 1, accepts motor drives, memo back. PRICE: \$902.50 with 50mm f/1.4 AI-S Nikkor; \$749.50 with 50mm f/1.8 AI-S Nikkor; \$1037.50 with 50mm f/1.2 AI-S Nikkor; \$647.50 body only, \$22.50 more for black body.

Perhaps no statement from once staid and conservative Nikon as to its new technological direction could possibly be as succinct as the one the company has made with the new Nikon FA. Where once Nikon was content primarily to refine and improve the innovations of others until they met with Nikon quality and reliability expectations, Nikon now also breaks new ground yet untrod. The FA does this not in introducing the first many moded Nikon but in tackling that dark area avoided by all other auto exposure cameras—the approximately 10% of picture taking situations which yield less than optimal exposures if left to a camera's own auto meterings. Backlight, brilliant light sources or reflections within the picture itself, off-centered main subjects, washed out brilliant subjects, blocked up shadows in sunsets are just some of the situations the FA has been programmed to overcome. So convinced is Nikon in the FA's ability to solve these problems faster, easier and better than even an experienced professional, that Nikon's designers expect the FA's AMP system (automatic multi-pattern metering) to be accepted and even depended upon in the future, even by demanding professional photographers.

But for the skittish who feel they still can reach the quarter mile post better with a stick shift rather than Nikon's AMP, Nikon has provided a center-weighted auto-exposure override.

We have spent much time in analyzing how the new AMP system works and have put it heavily to the test, trying to find its weak points as well as its advantages. We'll let you in on all of this but first we'd better examine the camera and put it in context. There certainly is an impressive feature array to cover even if there were no AMP at all.

The FA, in size and weight, falls mid-way between the heavier and bulkier F3 and the lighter and more compact EM and FG—in other words, in with the mid-range Nikon FE2 and FM2. The two piece copper-aluminum (silumin) body casting is very FE2-ish so it isn't surprising that it uses that camera's superfast Nikon-designed Copal-made eight quilted titanium foil blade shutter with its top 1/4000 sec. speed and X sync to 1/250 sec. (In tests on the FE2, we proved conclusively that the new shutter was definitely more vibration free than earlier, slower metal bladed shutters despite the high speed of the former). The metering circuit, like that of the FE2, provides continuous light measurement via silicon photo-diodes on either side of the eyepiece and TTL flash metering by means of a rectangular silicon cell which reads light from the film surface during the exposure. The Nikon SB-15 and SB-16B flash units which allow TTL flash on the Nikon FE2 and FG do likewise on the FA. Properly operating dedicated TTL flashes of other makes can also be used as can two or more flash heads all operating with auto TTL flash control. In automatic exposure modes with the flash operating, the FA shutter speed is automatically set to the flash sync speed of 1/250 sec. while in manual mode, you can also set slower speeds for a combination of flash and other light sources—just like the FE2. Further FE2-isms are the brighter interchangeable-from-within-the-mirror box screens (interchangeable with the FE2's) and the use of the FE2's motor drive—although the FA also has an improved motor drive of its own as we'll see.

While the Nikon FA uses a stainless steel



lens mount ring—like the Nikon F3 and FE2, it has adopted glass fiber reinforced polycarbonate for the top and bottom covers of black-bodied FAs, rather than metal. Chrome-finished FAs use non-reinforced ABS plastic material which is not quite as strong as the polycarbonate. However, both materials withstand bumps, dents and abrasions better than metal covers, in our opinion. Generally, technicians are divided over the superiority of plastic vs. metal for camera cover plates.

However, the FA, in terms of features, and mechanical and electronic concepts, is a far cry from the FE2. While building on the FE2's undeniable strengths, a quick look at the FA's controls and view through the finder indicates how far beyond the FE2 technology has taken Nikon.

A large shutter-speed dial with extremely bright, reflective silk-screened numerals might lull you into a false sense of "controls as usual." However, adjacent to the right of the dial and controlled by a knurled lug at its front is a pointer which can be clicked into position above four quite visible letters: an orange P for programmed exposure (in which the camera sets both the shutter speed and aperture) an orange S for shutter-speed-preferred operation (in which you set the shutter speeds from 1 sec. to 1/4000 sec. while the camera's metering system sets the aperture) a green A for aperture-preferred automation (the old Nikon standby in which you set the aperture and the metering system determines the shutter speed), and lastly, a white M which not surprisingly stands for manual operation. By viewing through the finder (a slight press of the shutter release turns on the circuitry for 16 sec.) and switching from one exposure mode to another you can quickly see what's what in the finder.

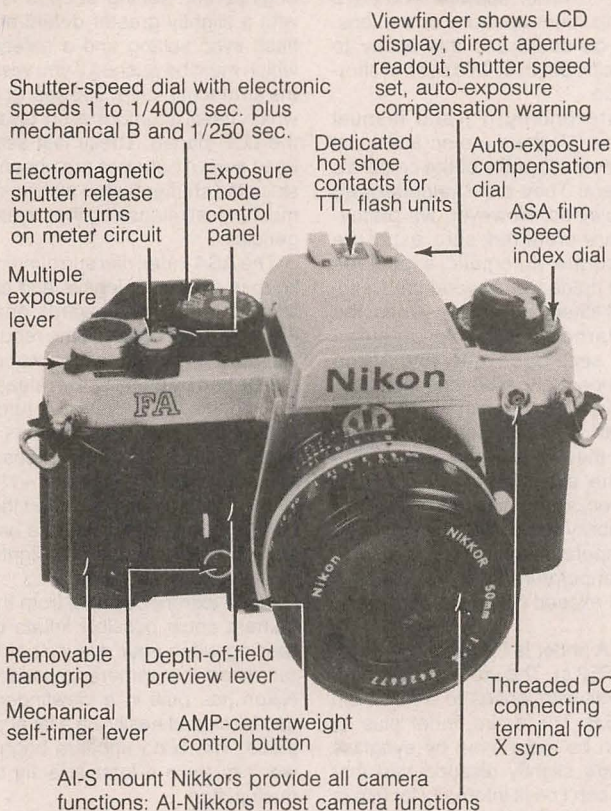
In (P) program, only the shutter speed to be used is seen in a clear rectangular LCD window above the finder area (drawing above). Switch to shutter-speed preference (S) and the LCD window shows you the aperture set while the shutter speed you've selected appears white against black to the right of the LCD window (drawing right). In aperture-preferred exposure mode (A), the aperture you select is reflected from the lens mount itself (ADR-aperture direct readout) right into a top central window while the LCD window indicates the shutter speed selected by the metering system (drawing right). Shutter speeds seen in the LCD windows are always full, marked ones: 1, 2, 4, 8, 15, 30, 60, 125, 250, 500, 1000, 2000 and 4000. While the actual setting of shutter speeds and apertures by the camera is infinitely stepless, the numerals shown are the closest full speeds and f/stops.

If you switch to manual (M), apertures are seen reflected from the lens again while shutter speeds are shown in the LCD panel (also with small plus and/or minus signs indicating whether the setting you've selected will result in over- or underexposure). When both + and - appear in the LCD panel, you have matched the camera's metering system—which in manual exposure mode is strictly center-weighted, no AMP correction.

Having given a recitation of the four exposure modes, rest assured that Nikon wouldn't abandon you, letting you make errors by using them improperly.

In (P) program, directions call for you to set each lens aperture to its smallest opening—usually f/16 or f/22. Should you not do so, the

## What's New At A Glance: Nikon FA



AI-S mount Nikkors provide all camera functions: AI-Nikkors most camera functions

warning letters "FEE" appear in the LCD panel instead of the shutter speed, (drawing right). What does FEE stand for? Apparently nothing in particular except to indicate you've made an error. But even if you should ignore the FEE, the camera will operate in program exposure from whatever aperture you have mistakenly set, all the way to the maximum aperture of the lens, if need be.

What, not done with program yet? Should you point the camera at scenes which are either too bright or dark for the camera's metering and exposure systems the warnings "HI" or "Lo" appear in the LCD panel. Unfortunately, when in the P program mode the aperture set cannot be read in the finder. Producing this would have required a rather major change in the Nikon lens mount which might have made it significantly incompatible with other Nikon lenses—a danger which, as you will see, Nikon has virtually avoided.

We now approach the unique Nikon FA system of programmed exposure automation. Nikon has reasoned after much research that it is the long focal length lenses which bear a major responsibility for unsharp photos. These long focal lengths, teles and zooms are difficult to hold steady, resulting in user-generated blur. Also, slow shutter speeds tend to magnify the blur caused by subject motion as well. Therefore the best possible (that is, the sharpest) long focal length lens pictures with the Nikon FA would be made if the long lenses were used at faster shutter speeds while shorter lenses would benefit from closing apertures swiftly as light increased, to offer more depth of field. And Nikon has provided just these two different types of program exposure settings for short and long lenses. For lenses shorter than 135mm, the exposure program closes the lens down to smaller apertures as soon as

the light increases sufficiently to enable a relatively slow, hand-holdable shutter speed to be set, while with lenses of 135mm or over, only the fastest shutter speeds are hand-holdable so the lens doesn't begin stopping down until these are attained.

What smart mechanism in the lenses tells the camera whether the lens is under or over 135mm? It's a little extra collar ridge on the back of the lens.

Since 1981, unbeknownst even to us, Nikon has been making new types of AI mount lenses called AI-S. These can be distinguished most easily by looking at the smallest marked aperture on the lens diaphragm ring. If it is orange it is AI-S. AI-S lenses including the Nikon E series of 135mm or longer (or zooms in this range) have focal length indexing ridges which press in the focal length indexing pin within the camera body. This highlights an important lens compatibility situation concerning older Nikon and Non-Nikon lenses in AI mounts, modified AI mounts and older mounts. For the purposes of this test report, we shall assume the lenses are all AI-S.

With shutter-speed priority, you are again instructed to set your lens to minimum aperture. The aperture will normally appear in the LCD panel as explained. But suppose you set too high or too low a shutter speed for the lens's aperture. Then the camera will correct the speed so you won't get over- or underexposed pictures. The exposure system now changes the shutter speed you've set to a usable one. However, the camera warns you of what it's doing. Instead of the aperture appearing in the LCD panel the new shutter speed picked by the camera appears while the "impossible" speed you selected still remains in view at the right.

Suppose you inadvertently set the lens's



## 35MM Single Lens Reflex

aperture to an opening other than minimum. Then the shutter speed priority mode will work within the narrower parameters between whatever smaller aperture you have set and the maximum aperture of the lens. Conceivably you could use this ability to maintain a specific depth of field even in shutter-priority mode.

With aperture priority (P) and manual exposure modes (M) there are no additional surprises or automatic shifts of the camera's exposure system. They are straightforward as already explained. However, we discovered in aperture-preferred auto exposure that quite accurate automatic exposures could easily be made well beyond the 1 sec. maximum limit cited by Nikon—when the LCD panel warned "Lo". We obtained upwards of 8 sec. Upon querying Nikon about this extended range, beyond their conservative estimate, (a situation we have run into before with other Nikons), engineers explained that they were well aware of the useability of the extended range but preferred to list 1 sec. as the maximum based on the camera's ability to operate to this speed even under temperature extremes. In moderate ambient temperatures we feel you can well and safely exceed Nikon's 1 sec. maximum.

The Nikon FA finder is impressively bright (similar to the FE2's). The split-image rangefinder works well with lenses to a minimum aperture of f/5.6. The entire finder plus all information can be seen even by eyeglass wearers. We are slightly disappointed that the LCD panel can't be lit internally for use in low ambient light levels. However, in most picture taking situations, all information is readily visible.

Controls of the FA are well situated. The nicely contoured wind lever pulls out to a working angle of 30° and requires only an exceptionally smooth, single 135° throw of the lever to advance film (thanks to its improved ball bearing advance system). When lodged snug against the camera body, the lever locks the highly sensitive electromagnetic shutter button, preventing inadvertent release.

The FA back swings open for loading in the manner of many Nikons. You pull up smartly on the rewind knob while pushing the camera back locking lever counter-clockwise. Film loads in the usual manner, but after you close the camera back, the camera operates at a mechanical 1/250 sec. until frame 1 is reached. This prevents the possibility of any inadvertently long exposures while loading. During film advance prior to frame 1, the viewfinder LCD panel displays "250" with a "c" preceding it, warning you that you have not yet reached frame 1.

The FA has a multiple exposure lever adjacent to the film wind lever which allows you to fire the shutter as many times as you wish without advancing film or frame counter. The 10 sec. self-timer is mechanical, not electronic, but does have the advantage of immediately causing the lens to close down and the mirror to swing upwards prior to exposure, thus minimizing any vibration—quite useful when taking pictures with long lenses, telescopes, microscopes or other high magnification closeup equipment.

The ridged depth-of-field preview lever adjacent to the self-timer is uniquely shaped for a Nikon, and closes the lens down when pressure is exerted downwards and forwards. Nikonophiles accustomed to in-push-

ing depth-of-field levers will have to get used to it.

The shutter-speed dial has been nicely engineered. Setting speeds is convenient, with a slightly greater detent at the red 250 flash sync setting and a safety lock button which must be pushed if you wish to switch to the all mechanical 1/250 sec. or B settings (in which case all information disappears from the LCD panel). These last settings can be used even if batteries are absent or are dead since the shutter button also has a secondary mechanical release ability for just such emergencies.

The ASA index dial surrounding the rewind knob is extremely legible and can be set by lifting the dial rim upwards and positioning the red rim dot opposite the required number. Up to  $\pm 2$  EV of auto-exposure compensation can be had by pushing the release knob adjacent to the ASA dial and turning the dial appropriately. At the extremes of ASA settings, 12 and 3200, auto-exposure compensation is limited to  $+1\frac{1}{4}$  and  $-1\frac{1}{4}$  EV respectively, hardly a penalty. When the auto-exposure compensation is used a bright red rectangular  $\pm$  warning LED lights at the right of the viewfinder image.

Since extraneous light from the rear of the camera could possibly inflate the exposure reading when your eye isn't at the eyepiece (as when the camera is used on a tripod), Nikon has built in a viewfinder blind which can be closed easily via a lever near the eyepiece. The blind appears bright red so you won't mistake it inadvertently for a camera malfunction.

The nicely contoured righthand finger grip is removable so you can fit the motor drives to the camera. Two are available. The Motor Drive MD-12 operable on the FM, FM2, FE and FE2 can be fitted to the FA (no, you needn't remove any bottom covers). With it you can shoot up to 2.7 frames per sec. at 1/125 sec. or faster, for more than 100 rolls of 36 exposures, powered by 8 AA alkaline energizers. However, the FA's own exclusive (no, it won't fit other cameras) MD-15 Motor Drive (\$260.00) reached 3.2 fps, but more important, it makes electronic contact with the Nikon FA camera bottom (via a removable cover plate) and eliminates the slight delay between trigger button pressure and camera release. Moreover, when the MD-15 is attached its 8 AA cells take over all meter and camera battery operations of the Nikon FA. Remote cord and cordless releases plus interval timers are available as accessories for both motors.

And now to the Nikon FA's unique meter system. While Minolta, in its CLC metering system for the discontinued SRT 35mm SLR camera series, and Mamiya, in some metering finders for the  $2\frac{1}{4} \times 2\frac{3}{4}$  in. RB 67 SLR, have used circuitry to compensate for backlit situations, no camera designers have gone to such great lengths as Nikon's to foresee and compensate for almost every picture taking eventuality where automatic center-weighted metering might lead you astray.

The system begins with the silicon photodiode cells which sit vertically behind their own optical systems on either side of the viewfinder eyepiece. They measure light from the focusing screen. Unlike cells in most cameras, a sharp image from the screen is projected on the cell surfaces. The cells are segmented into three sections. Together they read five segmented areas of the focusing screen, the center-weighted middle part

being shared by both cells. In regular AMP readings all cells read. You can always switch to a center-weighted reading whenever you wish by pressing in and/or locking the metering control button on the camera body lens mount below the self-timer. AMP readings can be made through AI-S and AI lenses but AI modified lenses (having no lens speed indexing post) only operate in center-weighted mode, irrespective of the position of the metering control button.

In manual mode, only centerweighting is available. In (A) aperture-preferred exposure mode, should you decide to push the depth-of-field preview lever during the exposure to make your exposure at actual shooting aperture, the center-weighted metering system takes over from the AMP.

Will the AMP system consistently give different exposures than the center-weighted? If you switch between them using the metering control button, you will quickly discover that the readings are most often the same. It is in only less than 10% of lighting situations that AMP will call for a different exposure.

What do the various segments of the silicon cells transmit? Not only the brightness values of each segment but also the differences among the brightness values of all five cells. Additionally, should all diode segments read more than  $16\frac{1}{3}$  EV indicating super extreme subject brightness—the AMP system automatically cuts the exposure down to  $16\frac{1}{3}$  EV to prevent underexposure. Likewise, if one or even two of the segments indicate a brightness of over  $16\frac{1}{3}$  EV, that cell (or cells) is automatically cut from the final exposure calculation. This is to prevent such errors as inflated readings caused by a brilliant reflection, the sun or some other light source directly in the picture itself.

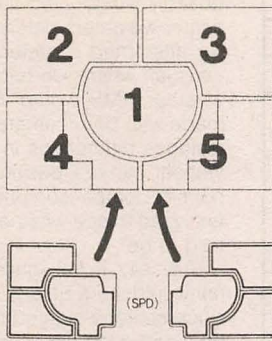
The simplified AMP operating (block) diagram above shows you rather succinctly how the system works. Starting from upper left, the informational output of the five cell segments is combined. To this is added necessary lens information. For instance, large aperture lenses such as f/1.4 and even f/2 have pronounced fall-off of brightness in the corners and edges. If such lenses are fitted, this brightness loss must be compensated for or the metering system will think the subject itself has such an edge and corner loss. The combined information, in total and separately, indicating high, low and brightness variations in the diode segments (plus whatever cell or cells may have been eliminated because readings over  $16\frac{1}{3}$  is now fed into calculation. This same information is also siphoned off for parameter judging where each of the cell's light patterns is analyzed. This small "parameters" rectangle is the key to AMP. Based on an individual analysis of over 100,000 actual picture taking situations the parameter judging alters the exposure selection circuit and the final proper AMP exposure.

Based on the subject and light analysis the AMP system selects center-weighted, high-light, midpoint or shadow readings as shown in the diagram. General lighting conditions run across from the brightest scene. With sun in it to dark night, while lighting conditions within the picture area run top to bottom from flat scene with no brightness range all the way down to very big differences in brightness (extreme contrast).

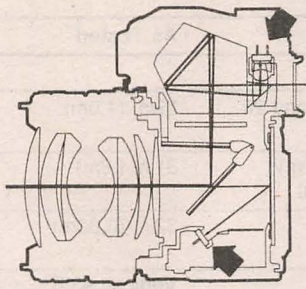
Where the total illumination exceeds  $16\frac{1}{3}$  EV, the AMP system cuts the total exposure



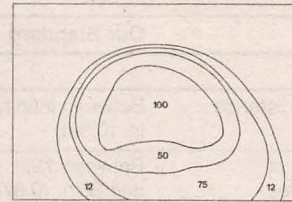
## Nikon FA metering: Something Very Different



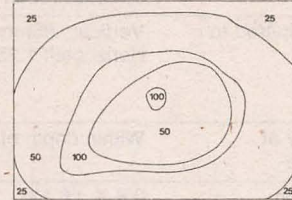
Both segmented silicon cells read centerweighted central area (1) while only left SPD reads (2) and (4) while right cells read (3) and (5).



Vertical SPD cells on either side of eyepiece (top arrow) read light for AMP and centerweighted continuous light readings. Cell in mirror chamber (bottom arrow) reads electronic flash from film during exposure.



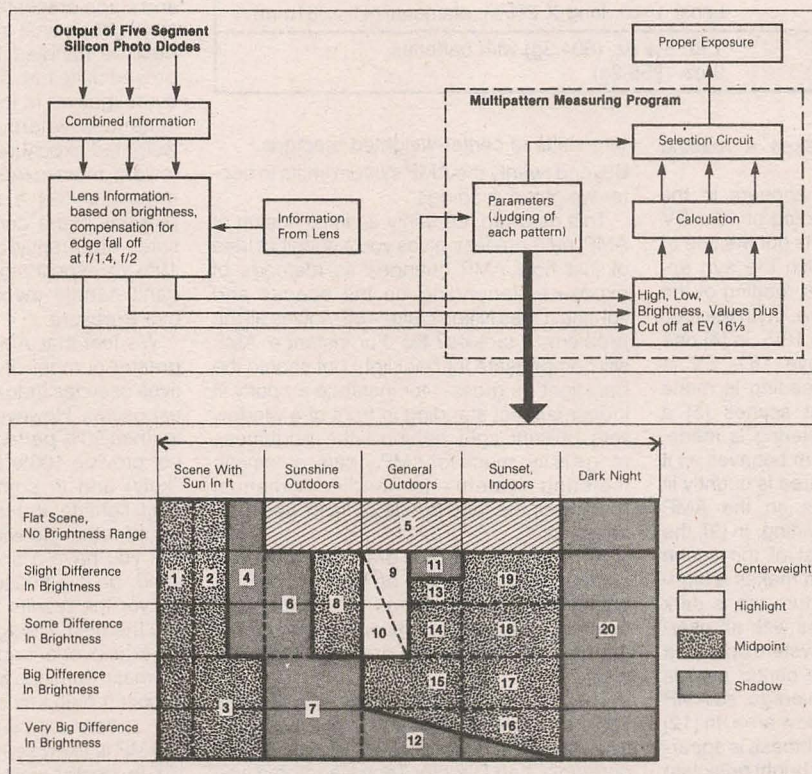
When used for standard center weighted metering, meter pattern resembles closely that you would find on many other Nikon SLRs



When we attempted to construct meter pattern using AMP setting, we obtained this interesting variation. However because of AMP's unusual operation pattern isn't really applicable.

## How The Nikon's FA's AMP Metering System Works

The block diagram below provides a basic step by step analysis of the AMP (automatic multipattern) metering system from the initial exposure of the silicon diode cells (upper left) to the final proper exposure (upper right). See text for more complete information.



The key to AMP-judging the scene: The innocuous rectangle in the top block diagram marked "Parameters" actually provides the key as to whether AMP will measure centerweighting, highlight, midpoint or shadow, depending on subject brightness and brightness difference. Directly above you see an analysis of how "Parameters" works. Test text has much more.



## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                                                                                      | As Tested                                                           |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                                                                                   |                                                                     |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                                                | 39in. (1.0m)                                                        |
| Apparent distance of shutter-speed scale | Between 79in. (2m) and 26in. (0.67m)                                                                                                                                              | 31in. (.8m)                                                         |
| Apparent distance of aperture scale      | Same as above                                                                                                                                                                     | 32in. (0.83m)                                                       |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%.                                                                                                                        | Vertical: 93%<br>Horizontal: 94%                                    |
| Parallax error compared to film          | Vertical: .85mm<br>Horizontal: 1.25mm                                                                                                                                             | Vertical: 0.05mm (up)<br>Horizontal: .15mm (right)                  |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                                             | No Discrepancy                                                      |
| Image magnification                      | 0.8 X $\pm$ 0.1X                                                                                                                                                                  | 0.82X                                                               |
| <b>PICTURE SIZE:</b>                     | 24 $\pm$ 0.6mm X 36 $\pm$ .09mm                                                                                                                                                   | 24.2mm X 36.3mm                                                     |
| <b>SHUTTER:</b>                          |                                                                                                                                                                                   |                                                                     |
| Curtain travel evenness                  | $\pm$ 0.33 stop                                                                                                                                                                   | -0.13 stop                                                          |
| Insulation from sync                     | More than 7 megohms                                                                                                                                                               | Infinity                                                            |
| Sync contact efficiency                  | More than 60%                                                                                                                                                                     | 92%(pc),<br>86%(Hot Shoe)                                           |
| Sync delay time                          | X: within full opening                                                                                                                                                            | Okay                                                                |
| Shutter curtain bounce                   | Not allowed                                                                                                                                                                       | None                                                                |
| Self timer delay                         | 7-15 sec.                                                                                                                                                                         | 10 sec.                                                             |
| <b>CAMERA SIZE:</b>                      | Body: 3 $\frac{5}{8}$ in. high, 5 $\frac{1}{8}$ in. wide, 2 $\frac{1}{2}$ in. deep (92 x 143 x 64mm)<br>Lens: 1 $\frac{5}{8}$ in. long X 2 $\frac{3}{8}$ in. diameter (41 x 61mm) |                                                                     |
| <b>WEIGHT:</b>                           | Body<br>Lens:                                                                                                                                                                     | 1 lb. 5 $\frac{1}{2}$ oz. (604.3g) with batteries<br>9 oz. (255.2g) |

down to 16 $\frac{1}{3}$  EV and makes a reading around midpoint.

Where the sun actually appears in the picture area providing a reading of 16 $\frac{1}{3}$  EV or more, the AMP system cuts out the one or two meter segments in which the sun appears and makes a midpoint reading of the rest to prevent underexposure. In [3] the total reading is again cut down to 16 $\frac{1}{3}$ . In [4] one cell with the sun in it above 16 $\frac{1}{3}$  EV is eliminated and a shadow reading is made from the remainder. In flat scenes [5] a straight center-weighted metering is made. In [6] and [7], the AMP system behaves as it did in four. In [8] the center area is brightly lit and backed by dark areas so the AMP system makes a midpoint reading. In [9], the center is brightly lit, the rest of the scene average, so the AMP system makes a highlight reading. In [10] the picture top is dark and the bottom light (such as with an overhanging porch) so the AMP system opts for a highlight reading. In [11] the center area is dark, the rest of the picture average, so AMP makes a reading for the shadow area. In [12] a very great difference in brightness is apparently caused by an unwanted bright reflection such as from an automobile body or windshield, so the AMP system takes a shadow reading. In [13]-[19] the AMP system calls for a midpoint reading, while a shadow reading is made at night [20] to provide the most detail possible. Beyond twenty the AMP sys-

tem shifts to center-weighted readings.

Beyond twenty the AMP system shifts to center-weighted readings.

This diagram, certainly a simplification of AMP, nevertheless gives you a succinct idea of just how AMP changes its methods of exposure depending on the scenes and lighting. Does Nikon claim AMP solves all the problems it tackles? No. For instance, AMP will compensate for backlight but should the backlight be gross—for instance a poorly lit indoor subject standing in front of a window with brilliant light behind—the brightness range is too much for AMP, or any automatic metering system—to handle. A manual reading of the face or use of flash would be called for.

Additionally, certain dramatic effects—such as a sunset—may be handled best by center-weighted readings. AMP may well give you a better overall average reading but this may detract from the dramatic effect you want.

Theory is fine but obviously in a MODERN TEST we must judge any design theory against actual picture-taking situations. Accordingly, Lab Director Tony Nagatomo was sent to Florida (it being winter at MODERN's home base in New York) with the Nikon FA set for AMP auto exposure and a second camera, a Nikon FE2, with center-weighted auto exposure. Using a 50mm f/1.4 AI-S Nikkor, a full series of actual color slide expo-

sures were made on Fujichrome 100 of subject and lighting situations where AMP supposedly would yield superior exposures to center-weighted metering. At the same time we attempted to detect situations, not too unusual, where we had not been informed whether AMP would work. Pictures were made with both cameras at various subject distance differences in both horizontal and vertical camera positions. In all, over 250 pairs of comparison photos were made and analyzed to see whether AMP was all it was said to be.

Basically, in flat lighting, AMP did nothing nor would there be any reason for it to do so since center-weighted metering has always provided good exposures under that condition.

In heavily backlit scenes in which the sun or other bright light greater than EV 16 appears in the picture area AMP definitely provides greater exposure, helping a backlit subject such as the girl's head as well as providing a better overall exposure for a sunset. However it's obvious that the traditional underexposure of the main scene given by center-weighted metering which measurely virtually the sun alone provides the more desirable sunset. AMP very nicely solved brightly lit outdoor scenes in which fairly largish shadow areas appeared, by increasing exposure.

Indoors, AMP had several surprises in store for us. An interior, heavily backlit by a central open patio door proved too much for AMP to handle however, the very same situation with the patio door in the right-hand sector of the picture responded perfectly to AMP.

We were told that certain night scenes such as neon lights, brightly lit cityscapes and stage presentations with performers in a spotlight against a black background would best be handled by centerweighting. This proved quite true as AMP tended to produce overexposure in these circumstances. In all instances where AMP altered a center-weighted exposure, AMP's corrections were toward more exposure. At no time did the system deliver a shorter exposure than a properly made center-weighted auto exposure. Apparently the big bugaboo is that 10% of exposures which center-weighting can't handle involve underexposure, not overexposure.

We feel that AMP certainly will deliver a greater number of properly exposed negatives or slides than will center-weighted auto exposures. However, if AMP can deliver better than 90% perfected exposures, it still will not provide 100% (about 95% seems more likely) and in some instances, even with back lighting and large central subjects, we would rather go with centerweighting.

If you have a specific dramatic effect in mind, be it a sunset or other, AMP will not deliver the results you wish. AMP will give you the best average exposure without bias towards over or under. So for underexposed dramatic sunsets, silhouettes or bright overexposed high key shots AMP does not hold the "proper exposure" key.

AMP is likewise no substitute for carefully made center-weighted meter readings in which you use the exposure hold button or auto exposure compensation dial to maintain a specific area reading. Your brain and knowledge of exposure (if you have one or the other or, hopefully both) will beat AMP or any other fully automatic exposure system.



But for straight point-and-shoot auto exposure, AMP will undoubtedly deliver more consistently than will center-weighting.

We certainly advise new owners of Nikon FA cameras first to gain experience with AMP once they purchase the camera by comparing both centerweighting and AMP readings on many different subjects under various lighting conditions so they will know when AMP will operate, how much the change will be and also learn when AMP does not operate to best advantage.

In our field tests of the Nikon FA we were luckier than with most cameras since we were able to use two samples quite exhaustively for periods of over a month, in some rather frigid wintry climes as well as high humidity and temperature areas in the South Pacific. Quite often the situations and necessity of quick shooting made it almost impossible to make accurate notations as to whether the AMP readings, which we relied on heavily, differed markedly from center-weighting (of course we did make up for this later in our extensive and careful Florida tests). But we were more than pleased with our slides often shot in blindingly bright tropical sunlight with deep foliated shadows. At all times, everywhere, the camera behaved as a Nikon should, with thorough reliability. (We did have some electrical contact difficulties though with the 3-volt lithium battery supplied, difficulties we had experienced previously with other 3-volt lithium batteries in other brand cameras. All cleared up as soon as we substituted two standard 1.5 volt silver oxide batteries).

#### PERFORMANCE

| Our Standard                                                                      | as Tested             |
|-----------------------------------------------------------------------------------|-----------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(47.50-52.50mm)                                 | 51.70mm               |
| <b>Aperture:</b> $\pm 5\%$<br>(f/1.33-1.47)                                       | f/1.43                |
| <b>Distortion:</b><br>( $\pm 1.5\%$ )                                             | less than 1% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.3 stops             |

#### RESOLUTION

| NIKKOR 50mm f/1.4<br>at 1:50 |                  |    |                  |    |
|------------------------------|------------------|----|------------------|----|
| f/                           | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 1.4                          | Good             | 50 | Excellent        | 45 |
| 2                            | Good             | 56 | Excellent        | 50 |
| 2.8                          | Good             | 56 | V. Good          | 50 |
| 4                            | Good             | 56 | Excellent        | 56 |
| 5.6                          | V. Good          | 63 | Excellent        | 63 |
| 8                            | Excellent        | 70 | Excellent        | 63 |
| 11                           | Excellent        | 63 | Excellent        | 63 |
| 16                           | V. Good          | 56 | Excellent        | 50 |

#### CONTRAST

| NIKKOR 50mm f/1.4<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------|---------------|----|---------------|----|
| f/                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 1.4                                 | High          | 64 | High          | 40 |
| 2                                   | High          | 72 | High          | 39 |
| 2.8                                 | High          | 78 | High          | 58 |
| 4                                   | High          | 80 | High          | 70 |
| 5.6                                 | High          | 72 | High          | 76 |
| 8                                   | High          | 75 | High          | 73 |
| 11                                  | High          | 67 | High          | 70 |
| 16                                  | High          | 66 | High          | 65 |

In terms of convenience, the FA's handling abilities seemed among the best we ever experienced with Nikons, which is not to put other Nikons down, but to praise this one. The removable handgrip was very comfortable and much appreciated.

We expect the Nikon FA to be perhaps the most discussed camera that manufacturer has ever designed. No photographer can ignore the fact that the FA offers the most comprehensive and varied automatic exposure systems available. It remains for the thoughtful photographer to select those which will best suit his needs.

While the 50mm f/1.4 Nikkor tested by us is in the newer AI-S mount which Nikon first put into production in 1981, the actual optical formula remains essentially the same as in the previous AI mount Nikkor which we had tested on the Nikon F3 back in June, 1980. However, its availability on the FA in its newer mechanical configuration gave us an opportunity of retesting this famous optic. **Field test slides:** Slides uniformly sharp and well exposed at all apertures and distances; flare well controlled, some softness in slides shot at full aperture but performance was above average by f/4.

**Optical bench analysis** (for optical experts only). On axis, we observed slightly under-corrected spherical aberration with slight flare, gone by f/8. Off axis, we could see slight skew-ray flare which disappeared by f/8 but with slight lateral color throughout. (March 1984)

## NIKON FE2 ADDS SUPERFAST SHUTTER AND MUCH MORE

**MANUFACTURER'S SPECIFICATIONS:** Nikon FE2 35mm single-lens reflex camera. Body No. 2001477. **LENS:** 50mm f/1.4, f/1.8, or 55mm f/1.2 Nikkor in interchangeable AI bayonet mount No. 3246632, apertures to f/22 (on f/1.8 tested), focusing to 18 in. (55mm f/1.2 to 24 in.), accepts 52mm accessories. **SHUTTER:** Electronically-timed, Nikon-Copal Square honeycomb titanium-blade focal-plane, speeds from 8 sec to 1/4000 sec. plus B, MX sync at 1/250 sec., self-timer. **VIEWING:** Non-interchangeable eye-level prism with interchangeable focusing screen having central split-image rangefinder, microprism collar with full-area focusing. **OTHER FEATURES:** Two 1.5 volt silver-oxide batteries (or 1 3-volt lithium) power silicon photo-diode circuit with diodes on either side of the eyepiece reading center-weighted area of focusing screen at full aperture; aperture-preferred automatic exposure (you set aperture, camera sets shutter speed); manual match-needle metering with full aperture control; stop down manual and auto-exposure control; shutter speeds, apertures, auto-exposure compensation plus over- and under-exposure warning signals in viewfinder; exposure memory lock; auto-exposure compensation dial; depth-of-field preview lever; shutter release lock; rear film box reminder slot; hot sync shoe with provision for specially coupled TTL autofocus; multiple-exposure provision; accepts motor winder and data back accessories. **PRICE: \$734.50 with 50mm f/1.4 Nikkor;**

## 35MM Single Lens Reflex

**\$581.60 with 50mm f/1.8 Nikkor; \$869.50 with 55mm f/1.2 Nikkor; \$479.50 chrome body only, \$22.50 additional for black finish camera body.**

Nikon's FE series occupies a specific niche in camera enthusiasts' needs. Starting with the family's primal ancestor, the Nikkormat EL of 1972, continuing with the motor winder-accepting Nikkormat ELW of 1976, the silicon photo diode-measuring Nikon EL2 of 1977, the smaller and lighter FE of 1978 and now the FE2, the line has constantly offered an electronically-controlled auto-exposure camera with metering needles and pointers visible in the viewfinder (rather than diodes) plus full match-needle manual metering. A glance through the viewfinder of the first Nikkormat EL and then through the new FE2 would show how closely Nippon Kogaku has hewed to this line.

This is not to say that other major changes besides those mentioned haven't been made. Over the years the auto-exposure speed range has been broadened, the metering improved from CdS to silicon cells, interchangeable screens, provision for motor and dedicated flash added, just to name a few of the advances. Certainly the newest in the line, the FE2 incorporates what may be the most significant changes yet: Compared to the FE, the major additions include a completely new Nikon-designed, Copal-made, eight-bladed, honeycombed titanium shutter, with speeds to 1/4000 sec. and flash sync at 1/250 sec., unique mirror vibration minimizers, through-lens, off-film, auto-flash metering system (similar to that on the Nikon FG and F3), simplified meter turn-on switch, focusing screens at least one full f/stop brighter than those on the Nikon FE and Nikon FM2 cameras.

Other less immediately visible improvements are: high shutter-speed film advance to frame 1, redesigned back safety latch, auto-exposure compensation warning in the viewfinder, improved ASA and auto-exposure compensation dial plus reinforced rear film box end reminder slot. Some minor features have been removed such as the battery check lamp (you can check the battery easily by seeing if the meter needle is working). A non-hinged plastic meter coupling lever has replaced the FE's lever with meter coupling release. Many (but not all) older non-AI (auto indexing) Nikon mount lenses may not fit the camera properly and could be damaged or cause damage to the camera. So mount any suspect lenses very carefully, and at any sign of resistance or improper connecting, desist! No, the Nikon FE cannot be adjusted to work with the older lenses but almost all older Nikon lenses can be modified to fit the FE2.

Time now to get at the camera. Not surprisingly, its configuration is almost precisely that of the FE but with a one oz. lighter body weight.

The view through the FE2's finder appears nearly identical to that of the FE—at first. Above, centrally is the reflected image of the lens's set aperture. At the left, just outside the picture area, you'll see the vertical shutter-speed scale with black meter needle and green transparent shutter speed and mode pointer. The scale of the FE2 provides slightly smaller speed figures in order to encompass the new 1/2000 and 1/4000 speeds at the top of the shutter-speed array.

Centrally, there is an ample split-image rangefinder, narrow microprism collar, 12mm meter centerweighting indicator circle and



## 35MM Single Lens Reflex

| GENERAL PERFORMANCE                      |                                                                                                                                                                                                                                                             |                                                   |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Checkpoints                              | Our Standard                                                                                                                                                                                                                                                | As Tested                                         |
| <b>FINDER:</b>                           |                                                                                                                                                                                                                                                             |                                                   |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                                                                                                                          | 39in (1.0m)                                       |
| Apparent distance of shutter-speed scale | Between 79in (2.0m) and 26in (0.67m)                                                                                                                                                                                                                        | 52in (1.3m)                                       |
| Apparent distance of aperture scale      | Same as above                                                                                                                                                                                                                                               | 31.5in (0.8m)                                     |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                                                                                                                                                   | Vertical: 93%<br>Horizontal: 92%                  |
| Parallax error compared to film          | Vertical: 0.85mm<br>Horizontal: 1.45mm                                                                                                                                                                                                                      | Vertical: 0.3mm (up)<br>Horizontal: 0.2mm (right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                                                                                                                       | no discrepancy                                    |
| Image magnification                      | 0.86.0.1X                                                                                                                                                                                                                                                   | 0.87X                                             |
| <b>PICTURE SIZE:</b>                     | 24 0.6x 36 0.9mm                                                                                                                                                                                                                                            | 24.2x36.2mm                                       |
| <b>SHUTTER:</b>                          |                                                                                                                                                                                                                                                             |                                                   |
| Curtain travel evenness                  | ± 0.33 stop                                                                                                                                                                                                                                                 | -0.026 stop                                       |
| Camera insulation from sync              | More than 7 megohms                                                                                                                                                                                                                                         | Infinity                                          |
| Sync contact efficiency                  | More than 60%                                                                                                                                                                                                                                               | 83% (Hot shoe)                                    |
| Sync delay time                          | X: within full opening                                                                                                                                                                                                                                      | Okay                                              |
| Shutter curtain bounce                   | Not allowed                                                                                                                                                                                                                                                 | None                                              |
| Self-timer delay time                    | 7-15sec.                                                                                                                                                                                                                                                    | 10 sec                                            |
| <b>CAMERA SIZE:</b>                      | Body: 5 <sup>1</sup> / <sub>16</sub> in. wide x 3 <sup>1</sup> / <sub>2</sub> in. high x 1 <sup>1</sup> / <sub>16</sub> in. deep (139x89.8x50.76mm)<br>Lens: 1 <sup>5</sup> / <sub>16</sub> in. long, 2 <sup>5</sup> / <sub>16</sub> in. dia. (34.5x59.4mm) |                                                   |
| <b>WEIGHT:</b>                           | Body: 1 lb. 3 <sup>11</sup> / <sub>16</sub> oz. (558.7g)<br>Lens: 7.3oz. (209.8g)                                                                                                                                                                           |                                                   |

full-focusing outer area. It seems like a regular Nikon K screen but it isn't. It's a K2 screen which is, we judged, one full f/stop brighter than a K screen (as are the B2 matte screen and E2 lined screen brighter than the B and E which fit the FE, FM and FM2 camera). Can you exchange the screens of one camera for another? Yes but you must make some exposure compensation.

The entire finder screen can be seen by eyeglass wearers if they keep an eye tightly behind the rubber ringed eyepiece (which will prevent eyeglass scratches).

Instead of the old style meter turn-on switch which required you to pull the wind lever away from the body (where you probably left it, thus draining the batteries), the FE2 has a switch incorporated within the shutter-release mechanism as do other modern Nikon SLRs. Slight pressure on the button causes the meter to be switched on for approximately 16 sec. The release button, by the way, is no longer a slender column threaded inside for a standard tapered cable release and outside for the traditional Nikon thread-on cable release. The outer thread is gone and the button face has been broadened considerably for better finger contact.

With the same-sized largish knurled shutter-speed dial as on the FE turned to the A setting (why is it now "A" instead of the full "AUTO" as on the FE?), slight pressure on the shutter release allows the traditional Nikon FE long black viewfinder meter needle to move downward over the shutter-speed

scale. The broad green transparent pointer remains atop the scale on the "A" for auto position. Slight changes in lighting conditions cause near instantaneous shifts in the meter needle position. It's easy to read shutter-speed indications, falling in between the marked values (which is why FE lovers stick to the needle rather than suffering the vagaries of approximating diodes or digital displays on other cameras).

There are two means of controlling auto exposure with the FE2 as there were on the FE, but both have been improved.

You can lock in any auto-exposure reading (such as a closeup measurement) by pressing the slightly redesigned and improved self-timer lever in, towards the body. The exposure remains locked in as long as pressure is applied—and the needle locks in place too. On the FE, the exposure locked in all right, but the needle itself kept showing the "unlocked" exposure reading, which was an annoyance.

You can also alter auto exposure using the auto-exposure compensation dial surrounding the rewind knob. Like that on the FE it is marked in ½ EV increments from -2 to +2 but is only operable at the extreme ASA indexes of 12 and 3200 only down to -1 and +1 respectively. The FE2 has reversed controls so lifting the outer rewind knob rim and turning it sets the ASA while pushing the small adjacent button and turning the whole dial sets the auto-exposure compensation dial. (On the FE, the controls were exactly oppo-

site). Why the change? So that the pushbutton control could turn on a bright red ± auto-exposure compensation warning signal at the right hand side of the finder screen, a welcome addition.

For manual exposure control, you press in the FE2's center unlocking hub of the shutter-speed dial and turn the dial to whatever manual speed you wish—from 8 sec. to 1/4000 sec. Each manual speed is now quartz-timed and thus splendidly accurate. Within the viewfinder the black pointer will continue to indicate the suggested shutter speed for the picture but now the green translucent pointer will move downwards to indicate the actual shutter speed you set manually. You can match black needle and green pointer for the recommended exposure or alter exposure as you wish, away from the suggested reading, by placing the green shutter-speed pointer upwards or downwards from the black pointer. The FE2 is thus ideally suited for fast exposure bracketing, another reason many pros and serious amateurs prefer this family of cameras over others.

The meter shuts off and the camera operates mechanically at two settings—a manual 1/250 (marked M250) and B. Thus the camera can be used even for electronic flash, in the event the batteries fail.

Opening the camera back for loading has been made more convenient by repositioning the camera back lock lever towards the rear of the rewind knob where it naturally comes into contact with your thumb as you pull upwards on the rewind knob. As a safety measure both actions are required before you can open the camera back.

Within, nothing appears new in the FE2 but two electrical contacts for the accessory data back, a slight change in the springs holding the film cartridge in its chamber and four of the eight titanium honeycombed blades of the new shutter, made by Copal but designed by Nikon (more about the shutter later). The backs of both the FE and FE2 are actually interchangeable, the only major difference being the beefed-up and easier-to-use film box reminder slot on the newer camera.

Film is loaded in the usual manner. You insert the leader end into one of two slits within the takeup spool. (We have never felt totally satisfied with the operation of Nikon takeup spool film leader insertion. It is easier in our opinion on many other brands of cameras).

Upon closing the camera back, you can advance film using, alternately, the shutter release button and then the well shaped, plastic-tipped single-stroke lever which travels 135° from its 30° off-camera operating position. (We would prefer Nikon to have adopted a multi-stroke wind lever system found on the metal-blade Seiko-shuttered EM and FG cameras).

Advancing film to the first frame is easier with the FE2 than on the FE. Until frame 1 is reached, the camera automatically sets its mechanical 1/250 sec. speed and the meter pointer within the finder remains inoperative. This eliminates the possibility of inadvertently long exposures caused by having the auto-exposure system operating in poor light or with a lens cap on until frame 1 is reached, a common inconvenience with many cameras. (It also prevents a user from erroneously using the metering system to shoot pictures on the exposed leader). The FE2 has furnished a numeral 1 in the ample-sized frame counter instead of the dot of the FE which precedes frame 2.



## Nikon FE2: What's New At A Glance

Finder system accepts new changeable screens brighter than in FE.

TTL autofocus hot sync. contacts incorporated in hot shoe similar to Nikon FG.

Shutter speeds 8 sec. to 1/4000 with quartz timed manual speeds, mechanical 1/250 sec.

Redesigned shutter button turns on meter circuit for 16 sec.

Release button allows auto exposure compensation with signal in finder.



Accepts same MD-11 and MD-12 accessory motor drive as FM, FE FM2 cameras.

Body casting similar to that of FE, FM, FM2.

ASA and auto exposure compensation scales shutter as well as speed numerals brighter.

Single piece stainless steel lens mount.

While the wind lever of the FE2 is similarly shaped and the single throw takes the same arc, the "feel" of the action is quite different as well as the sound. Gone is the rather audible ratcheting noise and gone too is the uneven lever movement caused by the ratchet system. The FE2 has a new four cluster ball bearing film advance which reduces torque and smooths out the entire film-wind motion.

While the broad top shutter-release button aids the smooth release action, there are far more important improvements which have been made to dampen mirror and shutter vibration in the FE2.

First, mirror shock. Traditionally, various spongy shock-absorbing materials have been used at the top of the mirror box to dampen the shock of the mirror's stop before exposure. The FE2 additionally incorporates a unique rotating flywheel mechanism to "supply inertia" to the mirror travel mechanism, thus suppressing vibration and bounce. Also, mirror shock is further dampened by the balancing movement of a rectangular plate at the bottom of the mirror chamber box. The plate, geared to the mirror, moves away from the mirror as the mirror rises and moves towards the falling mirror to minimize shock before and after exposure.

How successful are the fly wheel and plate in doing their job? We will see during our tests. However, in first examining the camera and pressing the shutter release, the reduction in shutter and mirror shock as compared to the FE can definitely be felt when both cameras are released at the same shutter speeds and set lens apertures.

The FE2's 9 sec. (our test result) self-timer, like that of the FE, is purely mechanical with a prominent white line down the setting lever to indicate to the subject approximately when the shutter will release (the lever then reaches the vertical position). It can be set to shorter times than 9 sec. and also can be cancelled prior to exposure if you wish. However, once the shutter release is pressed there is no way of halting the self-timer exposure. When the self-timer is used and the release pressed, the mirror immediately rises as in the FE thus providing excellent, even more vibration-free exposures.

Before completing the physical examination of the FE2 itself, commendation should be given for the larger, brighter engraved numerals on the shutter-speed dial plus the ASA and auto-exposure compensation dials. This has been accomplished by making the numerals bolder and using a paint in the engraved grooves with far better brightness and reflectivity.

We have tested the accessory 8 AA cell motor drive MD-12 w/FM-2. It fits the FE2 (as it does and did the FE, FM and FM2) with no need to remove any coupling covers on the camera. You can shoot either single shots or continuous bursts at speeds up to 3.5 fps for more than 100 rolls of 36 exposure film per set of alkaline energizer batteries. The motor drive can also be operated by remote control.

With the FE2, Nikon now has three camera models offering the undeniable advantages of through-the-lens auto-exposure flash metering right from the film surface during actual exposure. (The others are the FG and the top-of-the-line F3).

The FE2's auto-exposure flash ability is further enhanced by the latest Nikon-designed, Copal-made, eight-bladed honey-

combed titanium-shutter. Although the shutter is an outgrowth of the 10-bladed honey-combed titanium-blade shutter of the FM2, it is not the same shutter. To lighten the shutter further and increase its operating efficiency, Nikon engineers have pared the mechanism down from the 9 blades of the FM2. Further, the curtain travel speed of the FM2's shutter, already a staggering 3.6 milliseconds (half that of most other metal-blade shutters) has been trimmed to 3.3 milliseconds. While the top shutter speed of the FM2, 1/4000 sec., remains the same on the FE2, the electronic flash sync speed has been raised from 1/200 sec. (faster than on any other 35mm focal-plane shutter SLR) to a new high of 1/250 sec. This further minimizes any danger of unwanted secondary ghost images appearing in flash pictures caused by existing light. The 1/250 sec. speed is not only available as a manual quartz-timed electronic shutter speed (or automatically set by the proper dedicated flash unit), but also, as we've seen, as a mechanical shutter speed (marked M250 in white) to be used in case of battery failure.

Despite the increased shutter travel speed, Nikon insists that the 60% reduction in shutter mass over the shutters in other make SLRs results in practically no inertia or shutter bounce. Coupled with the mirror-movement-damping shock absorber and fly-wheel mechanisms, Nikon suggests picture sharpness should be improved over other cameras.

We decided to test the FE2 against the FE

and FG (with ordinary metal blades). The increased sharpness of the FE2, if present, would be most apparent in hand-holding the camera. However, since no two hand-held shots are precisely the same and the survey of thousands of identical shots made under like circumstances with each camera was not practical, we set up a rather simple test. Each camera, equipped with the same 50mm f/1.8 Nikkor lens, was in turn placed on a sponge like material. The camera was focused on our regular lab test targets at the proper distance using various speeds. The sponge-like material would let the camera jiggle with any mechanical movement thus allowing us to compare, relatively, the amount of sharpness loss caused by vibration and movement. The same test was also run with the camera mounted properly on a tripod.

How did our shots compare? At speeds of 1/30 and 1/60 second, the FE2 showed less vibration in our test photos. At faster and slower speeds, the difference was minimal. Of course, if both cameras are hand held at 1/30 and 1/60 second, tremors from hand holding would override any differences we found. But now back to electronic flash. The FE2's TTL flash system uses a square silicon blue cell located within the bottom of the mirror chamber, pointing backwards towards the film plane. It appears to be nearly identical to the cell used on the Nikon FG. Like it, the cell reads the flash illumination reflected from the film surface during exposure and adjusts the dedicated TTL flash duration accordingly to produce proper exposure.



## 35MM Single Lens Reflex

### PERFORMANCE

| Our Standard                                                                      | as Tested    |
|-----------------------------------------------------------------------------------|--------------|
| <b>Focal length:</b> $\pm 5\%$<br>(47.50- 52.50mm)                                | 51.25mm      |
| <b>Aperture:</b> $\pm 5\%$<br>(f/1.71-1.89)                                       | f/1.80       |
| <b>Distortion:</b><br>( $\pm 1.5\%$ )                                             | less than 1% |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.3 stops    |

### RESOLUTION

| Nikkor 50mm f/1.8<br>at 1: 51 |                  |                  |           |    |
|-------------------------------|------------------|------------------|-----------|----|
| f/                            | Center<br>(1/mm) | Corner<br>(1/mm) |           |    |
| 1.8                           | V. Good          | 51               | Excellent | 40 |
| 2.8                           | V. Good          | 57               | Excellent | 45 |
| 4                             | V. Good          | 64               | V. Good   | 51 |
| 5.6                           | V. Good          | 64               | Excellent | 57 |
| 8                             | Excellent        | 72               | Excellent | 64 |
| 11                            | Excellent        | 64               | Excellent | 57 |
| 16                            | V. Good          | 57               | Excellent | 51 |
| 22                            | Good             | 51               | V. Good   | 45 |

### CONTRAST

| Nikkor 50mm f/1.8<br>at 30 lines/mm |               |               |        |    |
|-------------------------------------|---------------|---------------|--------|----|
| f/                                  | Center<br>(%) | Corner<br>(%) |        |    |
| 1.8                                 | High          | 50            | Medium | 28 |
| 2.8                                 | High          | 60            | High   | 45 |
| 4                                   | High          | 62            | High   | 64 |
| 5.6                                 | High          | 77            | High   | 68 |
| 8                                   | High          | 74            | High   | 68 |
| 11                                  | High          | 68            | High   | 66 |
| 16                                  | High          | 56            | High   | 62 |
| 22                                  | Medium        | 41            | High   | 43 |

Not too surprisingly, the FE2 has the same dedicated flash sync contacts in its hot shoe as the FG. It accepts the same dedicated TTL flash units, the already available SB-15 (described in our Nikon FG MODERN TESTS) plus the more sophisticated SB-16B which features a 180° rotating and bounce zoom head to accommodate lenses from 24mm to 85mm and upwards, a secondary flash reflector to lighten eye shadows and provide eye highlights, plus manual ASA 100 film guide number of over 100. The unit operates on four AA cells. Unlike the flash units from any other camera maker, the SB-16B features interchangeable modules. The SB-16B can become the SB-16 for the Nikon F3 simply by changing the SB-16B's AS-9 flash coupler module for an AS-8 module (price not yet decided). Additionally, as the SB-16B with flash coupler AS-9, the flash unit can fit and operate properly in two auto-exposure distance ranges on any Nikon with an accessory shoe, offering whatever dedication each camera model incorporates.

As far as the SB-16B's ability in TTL mode for the FE2, FG or F3 is concerned, it has a range for ASA 400 film with a normal 50mm f/1.4 Nikkor to 178 ft. With a 105mm f/2.5 lens the range is 110 ft. With a 28mm f/2.8 lens the range is still a healthy 63 ft.

Either the SB-15 or -16 lights the readylight within the FE-2's finder when the flash unit is recycled to 80% full capacity and ready to fire. No matter how the camera is set in the A exposure mode, the shutter speed will automatically be set to 1/250 sec. It will also provide TTL auto exposure and be set automatically to 1/250 sec. if you have set the manual

speed between 1/500 and 1/4000 sec. However, to allow you to combine daylight existing light and flash you can manually set any speed between 8 sec. and 1/250 sec. and the unit will fire at that speed still providing TTL auto exposure. Flash can also be used at the M250 and B settings but not for TTL operation.

Besides serving as a flash ready lamp the viewfinder LED also warns when you are at the limit or beyond the TTL flash's distance range by blinking after the exposure. Additionally, it blinks before the exposure if you are beyond the ASA 400 range of the TTL flash's ability or if the camera in the TTL mode is set to 250M or B (in which case TTL auto flash isn't possible and you should switch to direct auto or manual flash).

In our field tests, we found the Nikon FE2 lived up to every expectation we have taken for granted with this fine line of cameras, offering superb handling and operation for amateur or professional work. While it may not have the ultimate ruggedness of the F3, it certainly still provides even the hard user who likes meter needles with an appropriate alternative to the F3's digital readouts.

Some words, however, concerning the camera's metering abilities. Nikon, we have often found, has long underrated the scope of its auto-exposure coupling systems. The FE2 is no exception. Despite the limitations found in an almost unbelievably complicated and near incomprehensible exposure capability chart found in the instruction book, our tests indicated the FE2 would operate properly far beyond the stated limitations. For instance, a reading of the chart indicates that the longest exposure that can be expected at ASA 400 and f/1.4 is 1/4 sec. This was incorrect. The camera read and operated down to 8 seconds. We noted that the entire exposure range from 8 sec. to 1/4000 sec. was useable at virtually all ASA indices for all apertures.

**Field test slides:** Slides uniformly sharp and well exposed at all apertures and distances; flare well controlled, some softness in slides shot at full aperture but performance was above average by f/4.

**Optical bench report** (for optical experts only): Slight red flare and spherical aberration visible on axis at full aperture, but both gone by f/4. Pattern near diffraction limit by f/8. Off axis, slight skew ray flare and slight astigmatism at widest apertures but gone by f/5.6. Off-axis star image pattern was near theoretical diffraction limit by f/8. (October 1983)

## NIKON FG: TTL FLASH ICING ON THE CAKE

**MANUFACTURER'S SPECIFICATIONS:** Nikon FG 35mm eye-level single-lens reflex camera, body No. 8201571. **LENS:** 50mm f/1.8 Nikkor-E in interchangeable mount (serial number 226995), apertures to f/22, focus to 24 in. (0.61m). **SHUTTER:** Seiko MFC-E electronically-controlled metal blade focal-plane shutter with speeds from 1 sec. to 1/1000 sec. plus B, X sync, self-timer. **VIEWING:** Non-interchangeable eye-level prism with central split-image rangefinder, microprism collar, full area focusing screen. **OTHER FEATURES:** Two 1.5-v silver-oxide, alkaline or one 3-v lithium battery power silicon photo-diode circuit. Cell above view-

finder eyepiece measures center-weighted area of focusing screen for continuous light exposures. Aperture-preferred auto exposure (you set aperture, camera sets shutter speed) and program auto exposure (camera sets both speed and aperture) with full manual speed override; shutter speeds, over- and underexposure, flash ready/O.K. diode signals in viewfinder, audible overexposure and 1/30-sec.-and-below warning signal, exposure-compensation button, auto-exposure-compensation scale, separate silicon cell reads flash from film surface for through-lens autoflash exposure via dedicated hot shoe and special flash units, film box reminder slot, accepts motor drives and data back. **PRICE:** \$419.50 with 50mm f/1.8 Nikkor; \$557 with f/1.4 Nikkor; \$481.50 with f/1.8 Nikkor; \$322.50 body only; \$17 additional for black finish.

When the small, compact, moderately-priced Nikon EM, featuring auto exposure only, appeared in 1978, we knew it must be the forerunner of a new family of Nikons. Certainly an EM-type camera with full manual override of exposure would be forthcoming.

The FG, built on the same metal body casting of the EM, is it. But it is far, far more than we expected. While retaining the light weight and size of the EM, it incorporates two auto-exposure systems, manual override with match-diode control, dual auto-exposure-compensation systems and, surprise: off-the-film, through-the-lens autoflash metering, a Nikon feature only found in the prestigious, professionally-oriented F3 camera.

The FG is not an EM with extra features tacked on. A cursory examination of both cameras would not reveal similarities to the average photographer. While the outer body dimensions and end configurations are the same, the wind levers similar and the rewind cranks identical, the EM's top structure, prism housing, controls and dedicated flash contacts are very different; the LED exposure control within the finder is quite unlike anything used previously on a Nikon. Only when the camera back is opened and the focal plane, shutter, film chamber, film rails, take-up spool and pressure plate system reveal both interiors to be nearly identical is the family relationship evident.

Whether you select the chrome model we tested or the black finished body, it's obvious that the attempt by Nikon to differentiate these cameras from other Nikons (seen on early EM cameras), by using different leatherish finishes and unpainted plastic parts, has been eliminated. The leatherish coverings and the chrome and black painted surfaces of the FG's plastic parts (principally the top and bottom plates) now bear the same finish as is used in all Nikon cameras—first-class.

FG controls are among the best designed and placed of any Nikon or other brand camera. The two-piece, hinged rapid wind lever pioneered on the Nikon EM has been retained but with the lever top slimmed down tastefully and the thumb plate contoured at a good angle.

Beneath the hub of the wind lever (containing the cable-release threaded mechanical shutter button) there's the concentric shutter-speed/mode-selector control dial. It's engraved very legibly with a large green A (for aperture-preferred auto exposure), red P (for programmed auto exposure—more about this later) and all manual shutter speeds from



1 sec. to 1/1000 sec., plus B and the mechanical 90 for 1/90 sec. The latter speed operates without battery power if needed for both standard illumination or flash. The shutter-speed/mode-selector control dial, a flat disc, is placed forward toward the front edge of the camera with the knurled rim protruding so that the ring can be controlled easily at eye level during match-needle (manual mode) exposure control. A convenient adjacent button acts as a lock for the A and P position so the dial won't stray from these settings inadvertently. To the left of the speed and mode control dial is the lever controlling the audible warning signal. When the lever is turned so the audible warning signal adjacent is visible, the camera will sound a beeping warning signal in the P or A mode when the shutter speed slips below 1/60 sec. and should have an additional support such as a tripod. It also sounds when the exposure required is beyond the top 1/1000 sec. speed. (This signal is similar to that on the EM except the beeper on the EM cannot be turned off when the noise is not desired.)

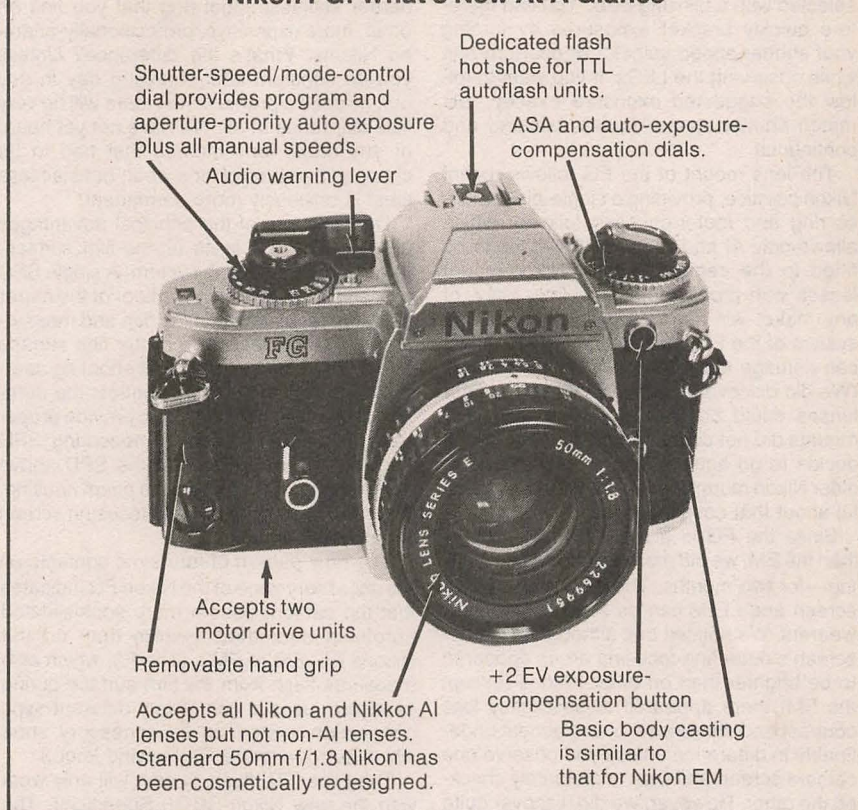
To the left of the camera's prism housing (as you hold the camera) is the inevitable rewind knob, folded rewind crank and surrounding dial containing both the ASA index scale from ASA 12 to 3200 and the auto exposure compensation scale ( $\pm 2$  stops in half-stop increments). As is often the case the full + auto compensation corrections cannot be applied at the lowest ASA indexes while the full - corrections don't work at ASA 3200. However, it is unlikely that these extreme indexes will have much use for the average photographer and more unlikely that he/she would be using auto-exposure compensation with them.

The ASA index has a spring operating lock rim while the auto-exposure-compensation correction is provided with a locking button. The two major ASA numerals 100 and 400 are marked in red; the ASA 64 dot is also red, while all other numerals are in a very legible white. Directly forward of the rewind knob on the camera front is a chrome ringed black pushbutton providing an instantly available 2 f/stop additional exposure for backlit and similar situations, so you need not be concerned with the auto-exposure-compensation dial when you're in a hurry to adjust for one or two quick shots. This is in lieu of a memory hold which would have the advantage of allowing close-up readings to be made but would have the disadvantage of not providing instant additional exposure.

Other front features are the traditionally placed Nikon lens-release button below the auto-exposure-compensation button and, at the far opposite side of the front, a lever for the mechanical 10-sec. self-timer which starts when the shutter release button is pressed. It can be negated anytime by pushing the lever back to its upright position. A comfortable hand grip is located at the far right side of the camera front. It can be removed using the slotted attaching screw and then left off or replaced with one of the two Nikon winders whose own vertical grip fits in the same position.

The camera loads in the usual manner after opening the spring back by pulling upward on the wind knob. The large, slotted, toothed, four-sided take-up spool is quite effective in holding the film leader securely. Like the EM and F3, the FG provides a constant 1/90 sec. shutter speed in the auto-exposure modes during the film winding until

### Nikon FG: What's New At A Glance



frame 1 is reached, thus eliminating the danger of unwanted long shutter speeds prior to frame 1, which can delay arriving at the first picture position.

With most metal-blade focal-plane shutter cameras, the wind lever stroke must be made in one single movement. However, in the FG (and EM) you can make a single 144° sweep or use a series of shorter strokes if more convenient. When you hold the FG to your eye, the focusing screen configuration appears quite similar to that on other Nikons with a standard K screen—split-image rangefinder, microprism collar and scribed 12mm diameter circle indicating the principal stressed area of the center-weighted metering system. To the right, protruding slightly into the screen area, is a transparent vertical shutter-speed scale marked in red from 1 to 30 and in black from 1/60 to 1/1000 to distinguish between hand-holdable speeds and those needing support. At the bottom of the scale is a zig-zag flash indication.

Slight pressure on the shutter release turns on the metering system. It will remain on for 16 sec. even if finger pressure is removed. To the right of the scale adjacent to but outside the picture area, red LEDs indicate the shutter speeds set by the metering system of the camera, or by user in manual control.

With the FG's shutter-speed/mode-selector dial set to A, the camera operates much as other aperture-preferred auto-exposure cameras. You select the aperture by turning the aperture ring and the metering system selects the shutter speed. This selected speed appears as a red LED opposite the appropriate speed numeral on the finder's speed scale. If the speed is between two marked settings, the two red LEDs opposite these settings will light. Blinking red LEDs light, top or bottom, when over- or underex-

posure will result from too much illumination or too little.

If the shutter-speed/mode-selector dial is set to P, the camera will select both the shutter speed and aperture, increasing both equally as light increases (see chart, above, right). However, to operate in the P mode, the camera lens must be set to f/11 or a smaller aperture. If you inadvertently neglect to do this, the over- and underexposure LEDs in the finder warn you by blinking alternately if you're using Nikon AI-mount lenses with the necessary activating lug.

While the finder shutter-speed scale will continue to indicate the speeds set in the P mode, you have no indication of the aperture set since the FG does not have any aperture scale in the finder. You can, of course, consult the program chart in the instructions to match the aperture to the set shutter speed, but this would be inconvenient in many picture-taking circumstances.

With films having ASA speeds of 100 or lower, the metering system in both A and P modes is completely coupled for all apertures and shutter speeds. However, at faster ASA indices, the slower shutter-speed setting ability is somewhat curtailed. For instance, with ASA 400 film, the metering system will read down to 1/4 sec. at f/1.4. However, if light is lower than that needed for 1/4 sec. at f/1.4, the metering system cannot set the exposure. The viewfinder shutter-speed indication will automatically jump from 1/4 sec. to underexposure, bypassing 1/2 and 1 sec. However, we did discover that the metering system could read down to 1 sec. at f/1.4 in manual match-diode control.

To use the FG manually, just turn the shutter-speed/mode-selector to whatever speed you wish and the lens aperture ring to the f/stop wanted. In the viewfinder, the shutter speed you selected will cause the LED oppo-



## 35MM Single Lens Reflex

site that speed to glow continuously. The camera's metering system will indicate the proper shutter speed for the aperture you've selected with a blinking LED. You can therefore quickly bracket exposures by turning your shutter-speed selector or aperture ring while observing the LEDs. If you want to follow the suggested exposure exactly, just match shutter-speed diodes, blinking and continuous.

The lens mount of the FG follows recent Nikon practice, providing a single-piece plastic ring and meter-coupling follower which allows only AI and AI-modified lenses to be fitted to the camera. Earlier Nikon-mount lenses with prong meter couplings only, of any make, will not work with the metering system of the FG, and attempting to fit them can damage the FG's meter-coupling lever. (We did discover, however, that some older lenses could be fitted provided their rear mounts did not contact the lever at all. If you decide to go against Nikon's advice and fit older Nikon mount lenses, be very, very careful about that coupling lever.)

Since the FG is a more serious camera than the EM, we did more extensive field testing—for two months. The FG's entire finder screen and LEDs can be seen by eyeglass wearers. We noticed that although the finder screen's outer fine-focusing areas appeared to be brighter than on other Nikons (except the EM) there appeared to be slightly less contrast and sharpness. It was almost undetectable in difference unless you observe one camera screen and then immediately checked the other. However, we did discover quite a difference in prism rangefinder ability—and this was all in favor of the FG.

It's commonly accepted that standard central split-prism rangefinders operate well at large apertures but begin to become difficult at f/5.6 where either one half or the other of the rangefinder goes dark. By very carefully positioning your eye directly behind the eyepiece you can sometimes still use the rangefinder at f/5.6, but it requires some concentration. At smaller apertures, the rangefinder usually becomes near inoperative. Not so with the FG. We were astonished to find that the two halves of the rangefinder remained clear and bright at f/5.6, and even proved eminently usable for pinpoint focusing with 500 and 1000mm f/8 mirror lenses!

Nikon apparently achieved this by lowering the slope angle of the two prism wedges in the rangefinder, but we did not find that the alteration caused any loss of focusing ability with extreme-wide-angle lenses where we might have expected a decrease. The rangefinder is similar to that employed in the Nikon F3's R screen, which has no microprism but is furnished with horizontal and vertical lines. The FG's screen will certainly be a boon for all tele lens users who have customarily had to ignore the rangefinders when using the small apertures.

Before going on to a most important accessory—the through-lens, off-the-film measuring SB-15 Speedlight—we should mention some features that the FG does not have that may be of importance to you. There is no depth-of-field preview control, no multiple-exposure provision, no apertures visible in the finder, no exposure memory hold (previously noted), no shutter or meter turn-off lock, no PC terminal for off-camera flash (although this can be overcome with an accessory as shown above). For most photographers these will be small losses compared to

the positive abilities of the camera.

Lastly, the FG uses a chrome-plated brass lens mount rather than the more expensive, harder stainless steel ring that you find on other, more expensive, professionally-oriented Nikons. What's the difference? Unless you do constant lens changing day in day out, as does a professional, there will be very little difference at all. We have not yet heard of any brass lens mounts that had to be changed because of lens wear, but stainless steel is obviously more permanent.

Certainly one of the principal advantages of the Nikon FG is its off-the-film surface, through-lens autoflash system. A single SPD (silicon photo diode) on the floor of the mirror chamber faces towards the film and measures the flash reflecting from the film surface during the actual exposure at shooting aperture. The silicon cell then controls the duration of the flash illumination to provide proper flash exposure. This flash measuring SPD shouldn't be confused with the SPD above the finder eyepiece, within the prism housing, that measures light from the focusing screen for all non-flash uses.

The new pattern of four sync contacts on the accessory shoe of the Nikon FG indicates that the camera uses a more sophisticated autoflash dedicated system than do the Nikons FE, EM or FM2. (The F3, which also measures flash from the film surface during exposure, uses a completely different sync connection system in its accessory shoe which surrounds the F3's rewind knob.)

The FG's TTL flash system will only work with the new Nikon SB-15 Speedlight. The flash has provision for full dedication with the FE, EM and FM-2 Nikons, but not for TTL flash. However, in this report we'll devote ourselves to the TTL flash only for the FG.

The SB-15 follows typical Nikon shoe-mounted flash configuration using a rectangular box shape ( $3\frac{1}{2} \times 3\frac{1}{2} \times 1\frac{1}{4}$  in.) with edge side flashtube and reflector. The unit swivels to a horizontal or vertical position. Unlike other Nikon units, the SB-15 incorporates a flashtube and reflector which can be angled upwards in 15°, 30°, 60°, and 90° click stops for bounce-light photography. By swinging the flash unit itself to a vertical position but angling the flash tube and reflector 90° away, vertical bounce-flash pictures can be made. Also the flash can be swiveled to an upside-down position and the tube plus reflector angled downward for close-up work.

The SB-15 is a four-AA-cell, energy-saving flash unit offering a maximum flash range of 59 ft. with ASA 400 film and an f/2 lens, for all focal length lenses from 35mm upwards. The manual guide number is 82 for ASA 100 film, and 164 for ASA 400 film. With the 28mm accessory panel (furnished) over the flashtube, the range with ASA 400 film and an f/2 lens is 39 ft.; the manual guide number is 60 for ASA 100 film and 120 for ASA 400 film. With alkaline energizers, a minimum of 160 flashes can be obtained on one set of batteries at an initial maximum recycling time of 8 sec. Although Nikon does not recommend it, you can use nicad AA batteries for faster recycling but fewer flashes per battery charge. Zinc carbon batteries can also be fitted if you don't mind the abbreviated number of flashes. (We found that under most indoor conditions the maximum autoflash distance ranges could be exceeded and you would still get correct exposure. However it is wiser to follow Nikon's conservative range recom-

mendations in the instruction book.)

When the SB-15 is attached to the FG and turned on with the mode selector at either A or P, the camera will automatically be set at the X-sync speed of 1/90 sec. However, when using manual speeds, the sync speed will only be set to 1/90 sec. if the manual speed set is 1/125 sec. or greater. If not, the camera will operate at that slower speed, providing the ability to mix existing light and flash.

Unlike many other SLRs with dedicated flash units, the FG will not revert to existing-light auto exposure while the flash is recharging. If the flash unit is turned on, the shutter speed in A or P modes remains fixed at 1/90 sec. whether the flash is recharged completely or not. Therefore, you must wait for complete recycling and the readylight to appear on the flash or in the viewfinder if you wish proper exposure.

If there has been insufficient light for a proper flash exposure, either because the subject is beyond flash range or you have used too small an aperture, the flash readylight in the finder will blink after the exposure to warn you that an underexposed picture has very likely been taken. This is the opposite signal to that in most dedicated autoflash units (which usually blink after exposure to indicate that there has been enough light for a proper exposure). So it is quite easy, if you have used other dedicated units, to get your signals mixed; you should learn the Nikon system and remember it.

Through-the-lens (TTL) flash metering such as is available on the Nikon FG provides the most flexibility in autoflash since you have the use of all lens apertures instead of a few selected ones, and you can therefore take maximum advantage of your flash power and depth of field at all times. Also the flash will provide proper exposure through all lens attachments, including bellows and extension tubes, or when shooting through microscopes or using long tele lenses. With TTL flash, however, you cannot make a pre-flash to see whether there will be sufficient light at the aperture you have selected. But the SB-15 has a large, very legible calculator dial that provides you with the TTL auto-exposure range for all apertures. From it you can get the necessary information as to the distance available at each lens opening.

The SB-15 also has an MD (motor drive) setting which provides  $\frac{1}{13}$  the maximum light output but allows the flash units to fire up to four times in succession at speeds as fast as 3.5 times per second. This is used principally in conjunction with the FG's motor drives for flash-sequence photography. At the MD (motor drive) setting the SB-15 can only be operated manually, with a guide number of 22 for ASA 100 film and 44 for ASA 400 film.

The SB-15 has a sync/multiple-flash terminal on its underside so you can hook the unit up with another SB-15 or other flash unit with the appropriate connecting cords for manual multiple-flash operation.

While there is at present no connecting cord to allow the SB-15 to move off camera for TTL autoflash operation, we expect that Nikon will make one. If not, independent accessory manufacturers will certainly produce them as they have for other dedicated-flash cameras.

Although we have discussed the SB-15 exclusively, other Nikon accessory shoe-mount flash units can also be fitted to the FG. They, too, will set the shutter speed to X sync



and light the flash signals in the finder. However, they will not provide TTL autofocus metering. Nikon warns of possible dangers to the flash circuitry when non-Nikon flash units are used in the FG shoe. Certainly no units dedicated for other cameras should be attached. However, non-dedicated, single-contact flash units can usually be operated—but make certain they are turned off and not charged when you put them on or remove them.

We shot an appreciable number of flash pictures with the Nikon FG and SB-15. The unit yields extremely good evenness of illumination, and handled greater auto-exposure distances than the official conservative numbers provided by Nikon.

The Nikon FG has a choice of two motor drives. It can be fitted with the same 2-fps MD-E as used on the EM, which operates on six AAA cells, or fitted with the new MD-14 motor drive that incorporates eight AA cells and provides two officially stated operating speeds: 2 fps and 3.2 fps. Both fit and operate on the FG (and the EM) in like manner. The FG's hand grip must first be removed by unthreading the slot headed attaching screw. Then either motor can be attached to either camera directly via the tripod socket with no need to unthread any bottom coupling covers. Both motors provide continuing sequence photos if the camera shutter release remains depressed. For single shots, you press and quickly remove finger pressure.

The MD-E is lightweight, weighing but 9 oz. with batteries and adding just 1 1/4 in. to the height of the camera. When we tested it on the EM, we obtained speeds of 2.25 fps and exceeded the 50 rolls of 36 exposures per set of alkaline energizers specified by Nikon.

The MD-14 with batteries weighs 18 1/2 oz. and adds 1 1/2 in. height to the camera. Our tests on the FG produced actual fps speeds of 2.06 and 3.27 fps, respectively, and again we exceeded the specified minimum number of 50 rolls per battery set. We were/are delighted by the light, compact, efficient MD-E motor, but disappointed in the concept of the MD-14. Certainly the MD-14 must be your choice if you need sequence speeds in excess of 3 fps, but it provides nothing else we could detect besides a faster speed. We found the camera far more convenient to hold with the MD-E attached. We had hoped to find an electromagnetic shutter release or terminal atop the MD-14's substantial hand grip, but it contains only a rubberized gripping surface. And since no electromagnetic release or terminal has been provided on either motor the FG (and the EM) cannot be operated by radio, multiple flash pulse or electric cable switch remote release.

It would be patently unfair to leave you with a negative feeling concerning this neat little camera. The need for remote control is, admittedly, limited. For the vast majority of SLR enthusiasts, the Nikon FG camera, its SB-15 flash, the E-series lenses and MD-E motor offer an incredible amount of efficiency, flexibility of operation, convenience, compactness and light weight that would be near impossible to match in any other SLR today.

We tested the FG with the latest E-series normal lens, the 50mm f/1.8. Its optical design of six elements in five groups remains the same as that of the 50mm f/1.8 Series E examined by us on the Nikon EM camera. At that time we found that the lens had been

| GENERAL PERFORMANCE                      |                                                                                                                     |                                                       |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Checkpoints                              | Our Standard                                                                                                        | As Tested                                             |
| <b>FINDER:</b>                           |                                                                                                                     |                                                       |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                  | 39 in. (1.0m)                                         |
| Apparent distance of shutter-speed scale | Between 26 in. (0.67m) and 79 in. (2.0m)                                                                            | 30 in. (0.77m)                                        |
| Apparent distance of aperture scale      | Same as above                                                                                                       | 33 in. (0.83m)                                        |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                           | Vertical: 93%<br>Horizontal: 92%                      |
| Parallax error compared to film          | Vertical: 0.89mm<br>Horizontal: 1.39mm                                                                              | Vertical: 0.20mm (down)<br>Horizontal: 0.05mm (Right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                               | no discrepancy                                        |
| Image magnification                      | 0.84 ± 0.1X                                                                                                         | 0.89X                                                 |
| <b>PICTURE SIZE:</b>                     | 24 ± 0.6 × 36 ± 0.9mm                                                                                               | 24.2 × 36.3mm                                         |
| <b>SHUTTER:</b>                          |                                                                                                                     |                                                       |
| Curtain travel evenness                  | ±0.33 stop                                                                                                          | 0.159 stop                                            |
| Camera insulation from sync              | More than 7 megohms                                                                                                 | Infinity                                              |
| Sync contact efficiency                  | More than 60%                                                                                                       | 90% (Hot shoe)                                        |
| Synchronizer delay time                  | X: within full opening                                                                                              | Okay                                                  |
| Shutter curtain bounce                   | Not allowed                                                                                                         | None                                                  |
| Self-timer delay time                    | 7-10 sec.                                                                                                           | 8 sec.                                                |
| <b>CAMERA SIZE:</b>                      | Body 5 1/4 in. wide, 3 1/2 in. high, 3 1/8 in. deep (133 × 89 × 54mm)<br>Lens: 1 1/8 in. long, 2 7/8 dia. (28 × 62) |                                                       |
| <b>WEIGHT:</b>                           | Body: 1 lb. 1 1/4oz (489g) w/batteries<br>Lens: 5 1/8 oz. (157g)                                                    |                                                       |

made extremely compact and lightweight partially by the many plastic parts substituted for metal in non-critical mount areas. All critical mounting rings remained metal, however. Thinner lens elements than on the standard 50mm f/1.8 Nikkor, a similar optical design, had also been used, bringing the total weight and size of the lens down to 5 1/2 oz. and 1 1/8 in. long, 2 3/8 in. in diameter, as opposed to the Nikkor's 7 1/2-oz. weight, 1 15/32 in. length and 2 3/8-in. diameter. Optical performance of the Series E lens had proved remarkable. Our conclusion was that the E-series lens had mechanical quality equal to that found in many compact lenses made by other camera makers but the lens was slightly rougher and did not have the precision parts found in the Nikkor lenses. Our opinion remains the same with the new lens. We feel it is fully worthy for amateur or moderate professional use.

The new 50mm f/1.8 Nikon Series E differs from its predecessors only cosmetically. The

E series lenses had originally been all black with rubberized control rings of a distinctly different surface than that used on Nikkor lenses. Apparently consumers objected, so Nikon redesigned the entire moderately-priced light and compact E Series so the

## RESOLUTION

| Nikon-E 50mm f/1.8<br>at 1:52 Magnification |                      |                      |           |    |
|---------------------------------------------|----------------------|----------------------|-----------|----|
| f/no.                                       | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 1.8                                         | V. Good              | 52                   | V. Good   | 33 |
| 2.8                                         | V. Good              | 58                   | Good      | 37 |
| 4.0                                         | V. Good              | 66                   | Good      | 41 |
| 5.6                                         | V. Good              | 66                   | Good      | 46 |
| 8.0                                         | V. Good              | 66                   | V. Good   | 52 |
| 11                                          | Excellent            | 66                   | Excellent | 58 |
| 16                                          | V. Good              | 58                   | Excellent | 52 |
| 22                                          | Good                 | 52                   | V. Good   | 46 |

## CONTRAST

| Nikon-E 50mm f/1.8<br>at 30 lines/mm |            |            |      |    |
|--------------------------------------|------------|------------|------|----|
| f/no.                                | Center (%) | Corner (%) |      |    |
| 1.8                                  | High       | 54         | High | 34 |
| 2.8                                  | High       | 66         | High | 44 |
| 4.0                                  | High       | 70         | High | 66 |
| 5.6                                  | High       | 74         | High | 73 |
| 8.0                                  | High       | 73         | High | 73 |
| 11                                   | High       | 70         | High | 72 |
| 16                                   | High       | 64         | High | 66 |
| 22                                   | High       | 54         | High | 52 |

## PERFORMANCE

| Our Standard                                                                       | Tested    |
|------------------------------------------------------------------------------------|-----------|
| <b>Focal length:</b> ± 5%<br>(47.50 - 52.50)                                       | 51.57mm   |
| <b>Aperture:</b> ± 5%<br>(f/1.71 - f/1.89)                                         | f/1.80    |
| <b>Distortion:</b> (± 1.5%)                                                        | <1%       |
| <b>Light falloff:</b> at f/5.6,<br>+1 stop from theoretical limit<br>(0-1.3 stops) | 0.6 stops |



## 35MM Single Lens Reflex

lenses' outward appearance closely resembles that of the Nikkors. Size and weight of the new 50mm f/1.8 Nikon Series E lens, however, remains precisely as in the older version. It should be noted that although both have footage scales indicating minimum close focusing distance of 0.6 m or 2.25 ft., they both actually focus to 24 in.

**Field test slides:** Our transparencies shot at maximum aperture exhibited some softness, but by f/2.8 they were crisp and snappy with very good detail out to the corners of the frame. Flare was well controlled at all apertures, even at unfavorable shooting angles. We judge the overall field performance of this lens to be above average.

**Optical bench analysis** (for optical experts only): On axis we observed slight violet flare at the widest apertures, but it was gone by f/4. Slight spherical aberration noted at f/2-f/5.6 was gone by f/8, and the lens exhibited a nearly diffraction-limited pattern.

Off axis, we observed slight orange skew-ray flare wide open to about f/4, but it was almost entirely absent by f/5.6. The pattern was virtually diffraction limited by f/11, and almost no lateral color was detectable. (January 1983)

## NIKON FM2: FASTEST SHUTTER AND SYNC

**MANUFACTURER'S SPECIFICATIONS:** Nikon FM2 35mm eye-level single-lens reflex camera. Body No. 7005331. **LENS:** 50mm f/1.8 Nikkor No. 3187063 in Nikon AI bayonet mount, apertures to f/22, focusing to 18 in. (45 cm), accepts 52mm accessories. **SHUTTER:** Nikon-Copal titanium blade focal plane with speeds from 1 to 1/4000 sec., plus B, X sync. at 1/200 sec. **VIEWING:** Fixed eye-level prism with interchangeable screen having central split-image rangefinder, microprism collar, full-focusing screen. **FEATURES:** Single 3-v lithium, two 1.55-v silver-oxide or 1.5-v alkaline manganese batteries power silicon photo diode (SPD) metering circuit with cells on either side of the eyepiece reading center-weighted area of focusing screen; shutter speeds, apertures, metering LEDs visible in finder; double-exposure provision; dedicated hot shoe; self-timer; shutter-release lock, depth-of-field preview; film-box reminder slot, provision for motor drive. **PRICE:** \$523 with 50mm f/1.8 lens; \$598.50 with 50mm f/1.4 lens; \$364 body only; \$16 additional for black finish.

Ever since its introduction in 1977, the Nikon FM has been a favorite of those amateurs and professionals who eschew the auto-exposure camera and electronically-controlled shutter. With or without a battery, the FM functions at all speeds and apertures in all weathers. Only in the matter of center-weighted through-lens metering does the owner have to bow to the inevitable—with the more reliable, shock resistant and accurate triple LED metering system taking the place of the traditional meter needle controlled by a hairspring galvanometer movement.

Since the discontinuance of the all-mechanical F2 in 1980 and the simultaneous ascendancy of the very electronic F3, the FM has become even more a rallying point for loyal, mechanically-operating, Nikon lovers—a reliable, convenient, excellent-handling

workhorse. And now, Nikon has taken every-one by surprise by providing an improved, updated, unique new version—the FM2—in which virtually nothing is lost from the older FM but in which many new features have been gained. The new features cannot be found on any other Nikon, nor on any other SLRs of any brand.

What hath Nikon newly wrought in the FM2 compared to the FM? The major features are a new Copal-made Nikon-designed blade shutter made of 0.2-mm-thick quilted titanium and providing a 1/4000 sec. top speed. The increased shutter speed, cutting shutter travel time to 3.5 millisecond. (about half that of other metal-bladed units) allows an X-sync speed of 1/200 sec. rather than the standard 1/125 sec.

For the average photographer this might not seem important, but it provides the action photographer with a motion stopping ability twice that of any other SLR. The higher sync speed further minimizes the dangers of ghost images forming from existing light illumination when electronic flash is used at fairly high existing light levels. Photographers can also utilize existing light along with flash at larger lens apertures, giving them more freedom of operation.

What else is new? Certainly the availability of interchangeable focusing screens using the same inside-the-mirror-chamber changing system and alternate all-matte B and lined E screens, as in the Nikon FE, is of paramount importance. Less noticeable but also significant improvements include: a better LED readout in which the +, - and 0 signals

indicating over, under and correct exposures light up themselves rather than diodes next to hard-to-see unlit symbols. These are outside the picture area. In the FM the symbols protruded into the picture.

The metering system is now turned on for about 30 sec. by slight pressure on the shutter release instead of by moving the wind lever out into operating position. With the latter system, there was always a good chance that the lever would be left in the out position, thus draining the batteries when the camera wasn't being used. Pressing in the lever now locks the shutter release instead of requiring the user to turn the locking ring around the shutter release. The upper limits of the ASA range have been doubled to 6400, the metering cell material has been switched from gallium to silicon. Why? We remember that only five years ago gallium was touted as having better and more consistent protection against infrared ray interference. Our tests then failed to confirm this. We suspect that in the long run, with both cell materials being of equal quality, silicon has probably proved less costly than gallium. In any event, we see no loss to users in the switch back.

The multiple-exposure control is now far more convenient. On the FM a small spring-loaded button atop the housing must be held while the camera shutter is recoiled with the other. On the FM-2 a spring-loaded lever, concentric with the wind lever, allows you to handle matters with two fingers of one hand.

Additionally, the film box memo holder on the back has been enlarged, making inser-

## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                               | As Tested                                          |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                            |                                                    |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                         | 39 in. (1.0m)                                      |
| Apparent distance of shutter-speed scale | Between 79 in. (2.0m) and 26 in. (0.66m)                                                                                   | 31.5 in. (0.8m)                                    |
| Apparent distance of aperture scale      | Same as above                                                                                                              | 52.5 in. (1.3m)                                    |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                  | Vertical: 93%<br>Horizontal: 93%                   |
| Parallax error compared to film          | Vertical: 0.85mm<br>Horizontal: 1.27mm                                                                                     | Vertical: 0.05mm (up)<br>Horizontal: 0.05mm (left) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                      | 1/2 depth of focus toward camera                   |
| Image magnification                      | 0.86 ± 0.1X                                                                                                                | 0.87X                                              |
| <b>PICTURE SIZE:</b>                     | 24 ± 0.6 × 36 ± 0.9mm                                                                                                      | 24.3 × 36.3 mm                                     |
| <b>SHUTTER:</b>                          |                                                                                                                            |                                                    |
| Curtain travel evenness                  | ± 0.33 stop                                                                                                                | -0.006 stop                                        |
| Camera insulation from sync              | More than 7 megohms                                                                                                        | Infinity                                           |
| Sync contact efficiency                  | More than 60%                                                                                                              | 86% (Hot shoe)                                     |
| Synchronizer delay time                  | X: within full opening                                                                                                     | Okay                                               |
| Shutter curtain bounce                   | Not allowed                                                                                                                | None                                               |
| Self-timer delay time                    | 7-10 sec.                                                                                                                  | 10 sec                                             |
| <b>CAMERA SIZE:</b>                      |                                                                                                                            |                                                    |
|                                          | Body: 5 5/8 in. wide, 3 1/8 in. high, 2 3/8 in. deep (142 × 90 × 60mm)<br>Lens: 1 7/8 in. long, 2 1/2 in. dia. (37 × 63mm) |                                                    |
| <b>WEIGHT:</b>                           |                                                                                                                            |                                                    |
|                                          | Body 1 lb. 3 1/4 oz (546g) with batteries<br>Lens: 7 3/8 oz (209g)                                                         |                                                    |



tion of the cardboard end easier, and the depth-of-field lever is ribbed for a better gripping surface. The new shutter required the self-timer lever to be closer to the lens mount; the lever contour itself has been redesigned and angled away from the lens mount, so it can be reached more easily.

The shutter-release collar has turned from metal to plastic, as has the base of the shutter-speed dial and rewind knob—all non-critical areas; but the rewind shaft itself, plastic in the FM and much criticized with reports of shafts having snapped under rough usage, is now of metal.

Instead of a standard hot sync shoe, the FM-2 sports a two-terminal dedicated hot sync shoe which provides a readylight within the finder when Nikon SB-15, SB-10 or SBE flash units are used. The light blinks in warning when the flash is set at speeds higher than the top 1/200 sec. sync speed. The 3.5-fps MD-12 Motor Drive which operates on eight AA-cells and drives about 100 rolls of 36-exposure film through the camera. The MF-12 data back, fitting the Nikon FM and FE, is equally suitable for the new FM2.

The FM2 sports a rubberized ring eyepiece to prevent eyeglass scratching. However, upon checking, we found that later FM cameras also had this improved eyepiece. But there are other small but new details sharp-eyed Nikon aficionados will notice on the FM2 that we judge inconsequential: a slightly different configuration of the film supply chamber and camera back take-up spool holder retainer spring, for instance. Body weight has been dropped 50 grams compared to the FM.

Into each FM2 a few small minus points do fall. You may have noticed at the outset of this report we carefully said "virtually nothing is lost from the FM." One loss may or may not be of importance to you. It's the meter-coupling lever that could be locked up on the FM—allowing older, non-auto-indexing (AI) Nikon lenses to be fitted and metered in the stop down mode.

The FM2 meter coupling lever is fixed in the down position and this can't be used with non-AI or unmodified lenses. There are some special-purpose lenses that also cannot be fitted.

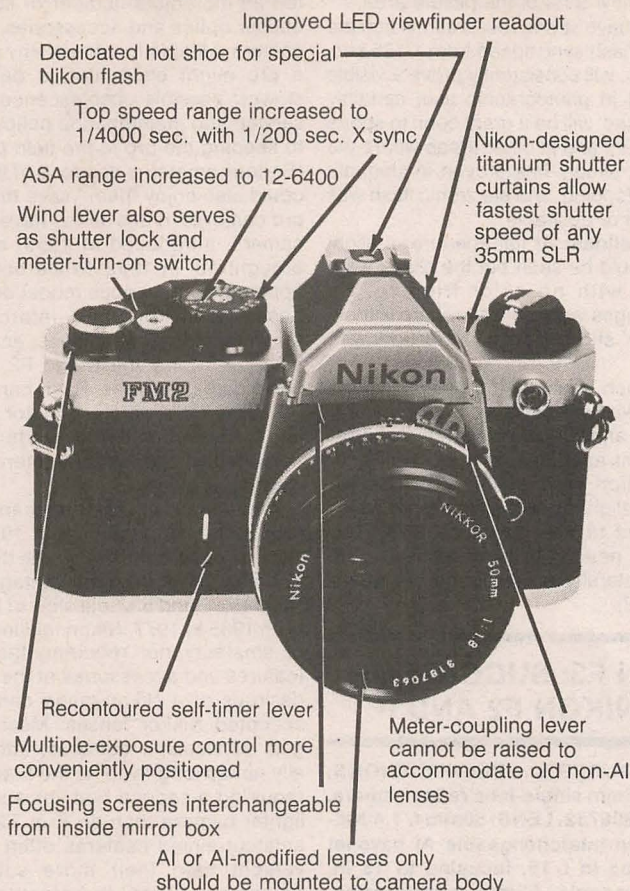
Why the fixed lever? Because the lever and spring-operated meter-coupling ring are now one piece of plastic instead of the rather elaborate all-metal construction of ring, hinged lever and release button on the FM. Certainly the new ring is far less costly to manufacture, but Nikon apparently believes that by now, few users will be much discommoded by the inability of the new camera to take the older non-AI lenses.

Two other unimportant but mysterious changes have been made. The outer rim of the shutter-speed dial has a less grippable knurling, and the knurling around the rewind knob has disappeared completely.

As to the exposures and finder ability of the Nikon FM2, in use they are near identical with the FM:

"The three red LED symbols in the viewfinder provide a round circle or zero central sign indicating proper exposure, a plus (+) sign above for overexposure and a minus (-) sign below for underexposure. Setting the exact exposure causes the 0 to light. Overexposing by between 1/5 to 1 full stop causes both the 0 and plus (+) diodes to light. Overexposure by more than one f/stop will cause only the plus (+) diode to light.

## Nikon FM2: What's New At A Glance?



"In the other direction, underexposure by 1/5 f/stop lights up the 0 and minus (-) diodes, while underexposure by more than 1 f/stop lights the minus diode.

"In picture taking, the persnickety photographer seeking perfect exposure will require seeing only the central diode light. However, an exposure change of just 1/5 f/stop can easily occur, so faster-working photographers may well settle for a central diode plus a top or bottom diode, figuring that any exposure within an f/stop is certainly within most films' exposure-latitude tolerances.

"If you need to make some swift emergency exposure compensation because of unusual lighting conditions, the three-diode system provides the wherewithal.

"Within the viewfinder, at the far left, you'll find the edge of a circular disc on which translucent shutter-speed numerals indicate the shutter speed set. Light for these enters the finder from the viewing screen, so your ability to see the numerals depends on the amount of light reaching the picture edge. The apertures appear above the finder screen and are actually white-on-black numerals engraved on a secondary aperture scale at the rear of the aperture ring on the AI or AI-modified Nikon-mount lenses themselves.

"We judged the finder image to be extremely bright, clear and contrasty—excellent for accurate focusing. The split-image rangefinder (of the K screen which comes with the camera) is large and easily usable with lenses having apertures of f/5.6 or larger. The 1mm micropism collar, in our opinion, could be broader for more convenient operation, but the entire outer area is extremely fine with no trace of Fresnel rings

### PERFORMANCE

| Our Standard                                                                      | Tested       |
|-----------------------------------------------------------------------------------|--------------|
| <b>Focal length:</b> ±5%<br>(47.50 - 52.50)                                       | 51.89mm      |
| <b>Aperture:</b> ±5%<br>(f/1.71 - f/1.89)                                         | f/1.83       |
| <b>Distortion:</b> ±1.5%                                                          | <1% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.3 stops) | 0.5 stop     |

### RESOLUTION

| Nikkor 50mm f/1.8<br>at 1:51 Magnification |                      |                      |           |    |
|--------------------------------------------|----------------------|----------------------|-----------|----|
| f/no.                                      | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 1.8                                        | V. Good              | 51                   | Excellent | 40 |
| 2.8                                        | V. Good              | 57                   | Excellent | 45 |
| 4                                          | V. Good              | 64                   | V. Good   | 51 |
| 5.6                                        | Excellent            | 72                   | Excellent | 57 |
| 8                                          | Excellent            | 72                   | Excellent | 64 |
| 11                                         | Excellent            | 64                   | Excellent | 57 |
| 16                                         | V. Good              | 57                   | Excellent | 51 |
| 22                                         | Good                 | 51                   | V. Good   | 45 |

### CONTRAST

| Nikkor 50mm f/1.8<br>at 30 lines/mm |          |            |        |    |
|-------------------------------------|----------|------------|--------|----|
| f/no.                               | Center % | Corner (%) |        |    |
| 1.8                                 | High     | 54         | Medium | 32 |
| 2.8                                 | High     | 74         | High   | 45 |
| 4                                   | High     | 84         | High   | 64 |
| 5.6                                 | High     | 80         | High   | 69 |
| 8                                   | High     | 80         | High   | 74 |
| 11                                  | High     | 82         | High   | 70 |
| 16                                  | High     | 66         | High   | 60 |
| 22                                  | High     | 56         | High   | 46 |



## 35MM Single Lens Reflex

and can be used for focusing right to the edges. Incidentally, with the Nikon FM (and FM2), you view 93% of the picture area."

While we have strong reservations that the increase in flash sync speed from 1/125 sec. to 1/200 sec. will consistently prove a visible major asset in photographic use, certainly the 1/4000 sec. will be a great boon to sports photographers and in other areas where the 1/1000 sec. simply has proven inadequate for motion stopping, and electronic flash was not practical or desirable.

**Field Test slides:** At full aperture, a slight haziness could be seen but the slides were short and with no color fringing. By f/5.6 the images were critically sharp without haze. Very slight barrel distortion was present.

**Optical bench analysis** (for optical experts only): On axis we found a very slight red-orange flare and very slight spherical aberration at widest apertures, but lens was near the diffraction limit at f/4. Off axis we observed a slight skew ray flare to f/4 which was reduced to very slight by f/5.6. The image was near diffraction limits by f/8. Almost no lateral color was detected. (September 1982)

## NIKON F3: SUCCESSOR TO NIKON F2 AND F

### MANUFACTURER'S SPECIFICATIONS:

Nikon F3 35mm single-lens reflex camera. Body No. 1200752. LENS: 50mm f/1.4 Nikkor in Nikon interchangeable AI bayonet mount, stops to f/16, focusing to 18 in. (0.45m), accepts 52mm accessories. SHUTTER: Electronically-controlled, quilted titanium foil focal plane with speeds from 8 to 1/2000 sec. plus B, X sync, electronic self-timer. VIEWING: Interchangeable eye-level prism with interchangeable focusing screen having central split-image rangefinder, micropism collar and full-area fine focusing. LCD panel shows shutter speeds set, indicates manual operation, over, under-exposure, aperture direct read out window, LED indicates flash ready, improper setting, under-exposure. OTHER FEATURES: Two 1.5-volt silver oxide batteries powered silicon photo-diode circuit. Cell in mirror chamber measures center-weighted area of picture through lens for continuous light, and reflected from film surface for auto-exposure electronic flash, aperture-preferred (you set the aperture, the camera sets the shutter speed) auto exposure, ASA 12 to 6400, full manual override,  $\pm 2$ -stop auto-exposure compensation, memory hold button, electromagnetic shutter release with additional mechanical release, multiple-exposure provision, depth-of-field preview, mirror lock-up, provision for special dedicated flash units, accessory motor drive, removable back, viewfinder illuminator, auto setting of fast shutter speed for first frame positioning. (Ed. note: Nikon F3 is available in three model variations, "High Point," "T," and "AF." Check with your dealer for current prices.)

Despite major efforts over the past 20 years by competitors to wrest Nikon's crown, it remains the 35mm SLR relied upon by the vast majority of professional photographers. The reasons pros depend on Nikons are multiple, but perhaps can be

boiled down as follows: They need a rugged basic camera body to which can be fitted an incredible number of sturdy, high-caliber optics and accessories making the camera suitable for almost any assignment a pro might encounter, a dedication to slowest possible obsolescence, and a pro service and maintenance policy dedicated to keeping the pro in the field operational. (Serious amateurs desirous of these points could also enjoy them—save the last.) The pro cameras in this series have been the F camera, introduced in 1959, and the F2, brought out in 1972. While both cameras appeared with various model designations based solely on their interchangeable prism metering capabilities, actually there have been only the F and F2 in terms of basic camera bodies. Each camera, F and F2, required a different motor drive, bulk film back and metering heads but did accept the same lenses and interchangeable viewing screens.

A camera manufacturer cannot live on pros alone, so beginning in 1960 with the Nikkorex and continuing with the Nikkorex Zoom of about the same vintage, the 1961 Nikkorex F and a whole slew of Nikkormats from 1965 to 1977, Nikon fulfilled the needs of amateurs not requiring the extensive features and accessories of the F or F2 but desirous of a Nikon-made camera which accepted Nikkor lenses. Most were rugged, serviceable cameras, although usually not as long-lived as the F and F2. Pros requiring a second body or a smaller and lighter camera than an F or F2 found the amateur-aimed cameras often more convenient than their more sophisticated equipment. They therefore mixed and matched them and their lenses with their F cameras.

In 1977, for better or worse, Nikon took the questionable step of renaming all their cameras "Nikon," thereby blurring for many the distinction between pro- and amateur-oriented equipment. As a result we had the Nikon EL (now discontinued), the Nikon FM, Nikon FE and, lately, the Nikon EM.

Pros seeking a more updated, automated, and lighter camera than the now somewhat antiquated and cumbersome Nikon F2 turned to the various alternative Nikons and consequently sent up howls when the cameras simply couldn't deliver hundreds of rolls per week in all temperatures. What were they looking for? Primarily an automated compact camera like the Nikon FE with the accessory flexibility, reliability and motor driven capability of the F and F2, plus a metering and battery system capable of withstanding operation in low temperatures. This is precisely the demand, be it from pro or serious amateur, which Nikon set out to satisfy in the F3.

While the F3 does have its own unique motor drive, finders, bulk film backs, and dedicated flash units, it has again preserved the photographer's most precious items from obsolescence—his lenses. All AI Nikkors work with full automation and convenience on the F3 and almost all non-AI lenses can be modified to AI specs. (And even those which Nikon claims are too old to modify can be adapted by independent repairmen to give full AI features, except aperture readout in the finder.)

Our first visual impression of the F3 was of a handsomely designed (by renowned

Italian automobile stylist Guigiaro), moderate sized (slightly larger than the Nikon FE), all-black SLR covered with the traditional Nikon pebble-grain leatherish-finish material. The matte finish metal is nicely counter-pointed by a vertical, pencil thin red stripe near the right-hand-side contoured handgrip. The F3 departs from Nikon practice (and that of just about every other 35mm SLR) in attempting to shape the physical dimension of the camera body to the hands of the photographer. Thus, in addition to rounded edges, the right front side of the F3 has the mentioned protruding built-in handgrip covered with the fine-grained material, while the left end of the camera has an ever-so-slight incline. These, as we'll see, contribute to making the F3 the easiest handling Nikon (or Nikkormat) ever.

In size, it is slightly larger than the FE and 4 oz. heavier. If you were to compare it to a Nikon F with a plain non-metering prism, you would find the size approximately the same. The F3 body size is comparable to the F2, but the F2's Photomic meter prism head makes it far more bulky than the F3. In weight, the F3 is about 4 oz. lighter than the F2. Only a few controls are carried over in design and placement from the Nikon F2: the front lens release button, the depth-of-field preview button and concentric rapid return mirror lock-up lever plus the rewind knob with folded rewind crank. The F3's contoured film- and shutter-advance lever is truly massive with a 30° off-camera rest position. You can wind in a single 140° stroke or in multiple strokes. At the hub of the wind lever is the threaded-for-cable-release electromagnetic shutter release. Its concave collar (the hub of the wind lever) is slightly below the level of the release button, so the ball of your finger fits nicely in the hollowed space atop the release. Adjacent to the shutter release is the shutter-speed dial, which looks and acts in a manner quite similar to that on the Nikon FE. For auto-exposure operation you set it at the green "A." For other than Nikon dedicated flash units there is an X sync setting of 1/80 sec. There is a white "T" for time exposures, red manual slow speed numerals from 8 to 1 sec. and white manual numerals from 1/2 to 1/2000 sec. (except for a red 1/60 sec. indicating the highest manual shutter speed that can be set for electronic flash). It's unusual to find a "T" setting on any 35mm SLR today. (The F had one, the F2 did not.) Ideally, a "T" setting opens the shutter on the first press of the release and closes it at the second pressing. On the F3 (and earlier Nikons), the shutter is closed by turning the shutter speed dial to another shutter speed. The "T" setting can be quite useful when making a prolonged exposure when you do not wish to maintain pressure on the release with the shutter set at B and you don't have a locking cable release. Both the "A" and "X" settings lock into place and can only be changed by pushing downwards on the center hub before turning it. All the rest are click-stopped. The dial has a heavily ribbed rubberish gripping ring.

The metering system and shutter release remain inoperative until the power switch lever near the shutter-release collar is pushed forward uncovering a red "on" dot. This activates the electromagnetic shutter release. Slight pressure on the shutter re-



lease then turns on the metering circuit liquid-crystal-display shutter-speed-indicating panel in the viewfinder. The display will remain on for 16 sec. and then turn itself off to prevent drain on the batteries, unless pressure is renewed or maintained on the shutter-release button.

Looking through the viewfinder (whose entire area can easily be seen by eyeglass wearers), you will find the traditional Nikon K screen arrangement of a 3mm diameter split-image rangefinder, 1mm-wide micro-prism collar, 12mm-diameter metering area indicating circle and outer matte-Fresnel focusing area. Above the screen and to the left of the direct aperture readout window is the rectangular LCD panel. The approximate shutter speed to be set by the camera's auto-exposure circuitry appears as a digital black numeral on a white translucent panel—much like the numerals on an LCD watch.

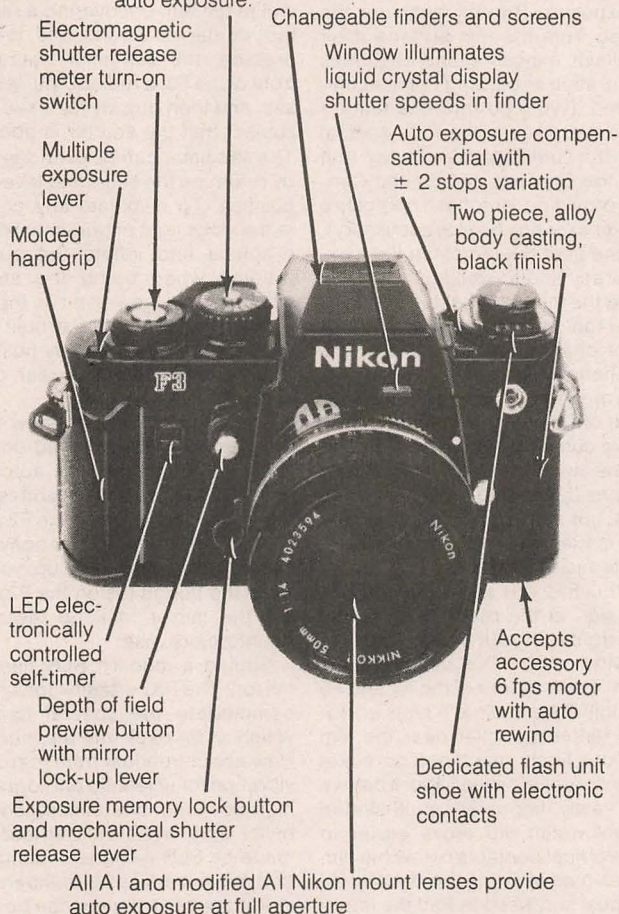
We stress "approximate" since the metering circuit itself provides continuously variable auto shutter speeds from 8 sec. to 1/2000 sec. Thus, if fractional speeds such as 1/343 sec. or 4.63 seconds are needed, that's what the meter will require the shutter to provide. However, to minimize confusion, the LCD panel shows the nearest full, shutter speeds: 8, 4, 2, 1 second, 1/2, 1/4, 1/8, 1/15, 1/30, 1/60, 1/125, 1/250, 1/500, 1/1000 and 1/2000 sec. To make readings easy to follow so numerals do not change constantly, each numeral remains for at least 1/2 sec. even if the light level is changing swiftly. The metering system reacts virtually instantly in resetting the shutter for new light levels. The panel shows full-sized numerals, so 1/250 sec. appears as 250. It indicates speeds of one full second or longer with a short hyphen following the numeral. Numerals without hyphens are all fractional. If a longer exposure than 8 sec. is required, a minus appears before the 8 sec. LCD numeral, meaning you'd better make a time exposure or use a larger lens aperture. If there is danger of over-exposure a plus appears in front of the 2000 numeral, meaning a smaller lens aperture or lower ASA film or a filter is required.

When the shutter-speed dial is set to manual speeds, an "M" appears before the numeral on the LCD panel. The panel then shows the quartz-timed manual shutter speed you set. If the speed you select is less than the meter suggests, a small minus appears above the M. If the speed is longer than the metered exposure, a plus appears above the M. When both a minus and plus appear above the M, your shutter speed choice has matched that of the meter. You can therefore vary your exposure from that suggested by the meter as many stops as required without taking your eye from the viewfinder. For instance, once you have matched your selection and that of the meter, you can underexpose by one f/stop by shifting either the shutter speed dial or aperture rims by one click stop lower. For two f/stops, use two click stops lower. You can make bracketed exposures swiftly in this way.

There are two additional means of altering exposures. Should you wish to keep your camera on auto exposure, you can make a close-up reading of the subject and then press the exposure memory lock button on the front of the camera. The exposure as well as the reading on the LCD

## What's New At A Glance: Nikon F3

Quartz crystal-timed 8-1/2000 sec. shutter speeds with locked A and Y settings. Aperture preferred auto exposure.



panel will remain locked as long as the button is held. You can then recompose your picture or return to camera position and shoot while maintaining your reading.

Should you wish to make a number of auto exposures at a specific amount of under- or overexposure, such as when copying documents or shooting distant scenics, use the auto-exposure-compensation dial next to the rewind knob. Push in the dial lock and rotate the dial collar until the white dot on the collar matches the compensation needed. Compensation in locked click positions is available in 1/3 stops from -2 to +2 stops. There is no indicator in the finder to warn you that the auto-exposure compensation is being used, so you must remember to return the dial to zero when no longer needed.

Normally the illumination for the LCD panel is transmitted through a front translucent panel at the bottom front of the prism. A separate mirror reflecting system transmits the lens opening set from the lens aperture ring. However, if the picture taking area is dark it may be all but impossible to see these numerals. By pressing a small red button on the right side of the prism you turn on a small grain-of-wheat bulb which furnishes just enough light to illuminate both the aperture and LCD panel, a most welcome feature.

The metering system itself is quite unlike anything ever used before by Nikon. A single silicon cell sits at the bottom of the

rapid return mirror chamber, pointing backwards and angled slightly upwards so it is pointed directly at the center of the film area. The mirror itself has a small central rectangle containing about 50,000 unsilvered oval holes which pass approximately 7 percent of the light hitting the mirror to a secondary hinged mirror resting at right angles to the main mirror.

The secondary mirror is actually made up of three sections, a central one with vertical lines and two wings with Fresnel patterns. They concentrate the light and redirect it to the silicon cell, which has its own two-element collecting lens.

The rectangular area on the rapid return mirror has no holes in the very center. Why? Because they would disturb the accuracy and ability of the split-image rangefinder and micro-prism collar. Why are the tiny holes oval? Because the mirror is at an angle. Individual light beams entering the lens strike the mirror in an oval pattern. The rectangle, just barely visible to the naked eye when you take your lens off and peer at the mirror, can't be seen through the viewfinder. A comparison between the F2 and F3 does not reveal any appreciable loss of viewing brightness caused by the rectangle in the F3.

Unlike other Nikon metering systems, which provide a center-weighted metering pattern in which 60 percent of the sensitivity is located within the 12mm viewfinder circle, the F3 concentrates 80 percent



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within the circle, an increase often requested by serious photographers.

The same silicon cell also provides auto exposure for electronic flash. When the rapid return mirror swings out of the way during the exposure, the cell measures the light reflected from the film surface itself during the flash exposure and regulates the flash's duration according to the illumination needed. (We'll go into this feature further when we discuss the F3's special flash units.) It's sufficient now to say that the F3 joins the Olympus OM-2N and Contax 139 in providing autoflash exposure through the lens (or any optical accessory), thus giving the user the utmost in flash exposure accuracy and flexibility.

By locating the meter cell within the camera body, Nikon has obviated any future possibility of changing metering systems by merely changing prisms—an F and F2 feature long argued pro and con. However, the inclusion of the cell within the camera allows a more compact camera design and eliminates the need for various exposure compensations depending on the focusing screen used, but more important, provides metering no matter which of the many viewfinders is fitted to the camera.

To load the F3, you push the camera back lock lever, at the rear of the rewind knob, to the right with your thumb while lifting the rewind knob. The camera back swings open. The interiors of the F2 and F3 are surprisingly alike, but the F3 has an additional film flattening roller near the film chamber, more finely machined sprocket teeth on the sprocket wheel and what we felt was a vastly improved multi-slotted take-up spool which did prove easier to load. Two electrical contacts below the film plane are, we presume, for the data back.

We were most surprised to find the interchangeable backs of the F2 and F3 to be nearly identical in features, contours and size save for a different matte black finish and pressure springs over the film chamber. Both have memo slots at the back into which you can insert a film box end. The backs between the F2 and F3 would almost be interchangeable save for a slightly different hinge pin arrangement and a few other minor points. This would lead us to believe that the forthcoming bulk film back for the F3 plus other rear accessories may be quite similar to, and perhaps even usable on, the F2's.

Film loads in the usual manner with the F3. However, once the back is closed and the slack taken up with the rewind knob, it is far simpler to wind to the first exposure since the camera automatically sets the shutter speed to 1/80 sec. until the first exposure is reached. With other auto SLRs you usually must set the camera manually to a manual shutter speed to prevent the auto-exposure metering system from setting long exposures during initial winding, particularly if you keep the lens cap on. When frame 1 is reached the camera automatically reverts to auto-exposure automation.

The frame counter is marked in blue against black with numerals at every five frames and dots in between. It has unusually good visibility. Directly in front of the frame counter, to the right of the film-wind hub is the multiple-exposure lever. After taking a first exposure, you flip it to the right and wind again. On the second wind the

film does not advance nor does the film counter. After the exposure, the lever flips back to the off position.

The self-timer is electronic. To set it, you move a lever forward of the shutter-speed dial to the left, uncovering a red dot. When the shutter is wound and the release is pressed, the self-timer operates. At the front of the F3, a red LED pulses slowly for 8 sec. and then quickly for 2 sec. to warn the subject that the shutter is about to go off. The self-timer can be overridden at any time by returning the self-timer lever to the "off" position. To eliminate any possibility that extraneous light might enter the viewfinder eyepiece and inflate the auto-exposure reading when using the self-timer (or whenever your eye isn't at the viewfinder eyepiece), the F3 has a built-in eyepiece blind. It can be closed by pushing a small lever to the left at the rear of the prism housing.

The depth-of-field preview button (also required for making closed-down-aperture exposure readings with auto-diaphragm, non-AI Nikkor lenses) operates in precisely the same manner as on the F2 and is, as on the F2, ideally situated for convenient operation. To lock the mirror up, you must push in on the button (as on the F2) while pushing the mirror lock up lever about 70° counterclockwise.

Should a modern SLR need a lock-up mirror? The F3 certainly does need it to accommodate the special fisheye lenses which sit far back into the mirror chamber. How about freedom from mirror movement vibration for scientific photography such as high-powered photomicroscopy? It's our belief that, while vast strides have been made by SLR designers using such vibration minimizers as air dampers, the utmost vibration-free situation can be created only with a mirror lock-up. In any event, whether you ever need it or not, it's there on the F3.

The F3 has a far simpler method of prism and focusing screen removal than the F or F2, which required the aid of a pointed instrument to push in an often recalcitrant release button on the back of the camera. With the F3, you just push a prism release lever backwards on either side of the prism and the prism can be lifted directly off.

No more need you turn the Nikon upside down while pushing the release button to remove a focusing screen. A generous slot allows you to insert even a short fingernail beneath the lip of the focusing screen mount. The screen slides right out and can be held by the lip or mount edges. If you have no fingernails, a thin coin edge will do the trick. Twenty focusing screens, much the same in pattern as for the F and F2, are available for the F3; however, because of the different mounting system the screens are not interchangeable between the older cameras and the F3. Replacing the screens and finder is simply a case of pushing them back into place.

The interchangeable finders for the F3 also resemble those previously available for the F and F2 but also are not interchangeable with those for the older cameras. Operationally, the major difference between the F and F2 finders and those for the F3 is that you retain full metering capability and ability to view the apertures and shutter speeds through the new finders on the F3. Although they were not available at test time, a DA-2 Action Finder, DW-3 Waist

Level Finder and a Dw-4 6X Magnification Finder are expected soon.

The standard DE-2 finder, you will note from our General Performance Chart, has an actual image magnification of 0.78X. This is somewhat lower than we have measured on other Nikon cameras (the Nikon FE had 0.88X, for instance), but is in keeping with the Nikon F2 magnification. While a quick comparison between a camera such as the FE and F3 will show that the FE has a larger (greater magnification) image on which to focus and view, the F3 provides greater eye relief—allowing eyeglass wearers, as previously mentioned, to see not only the entire finder but the LCD panel and aperture readout window as well. If the photographer is wearing goggles or other eyewear, he will be able to view through the F3 more easily, although the image won't be as impressively big as with the non-professional cameras.

The DE-2 viewfinder accepts the same screw-in interchangeable corrective eyepieces as all the other Nikon cameras. The standard screw-in eyepiece of the F3, however, comes with a heavy rubberized outer ring to prevent eyeglass scratching and to increase comfort among non-eyeglass wearers. It easily peels off the eyepiece—too easily, we noted, and can become lost. We found that a slight touch of rubber cement on a few spots of the rubber ring's inner rim solved this problem nicely and yet allowed the ring to be removed and replaced on another eyepiece when required. The ring, however, will not fit the smaller-diameter eyepieces of the FE and FM which enable the backs of these cameras to open for loading.

One of the major problems facing the manufacturers and users of SLRs today is that of battery failure. With the advent of the electronically-controlled cameras, it has been not only the metering systems which fail to operate when the batteries die but the entire camera. But fewer and fewer photographers, including professionals, are willing to depend solely on non-metering mechanical cameras and separate hand-held meters. Battery problems to date include poor contacts, sudden failure and inability to operate in low temperatures.

Nikon has taken all of these problems under consideration in designing the F3. The two 1.5-volt MS-76 batteries suffer from all the standard problems of their breed. At 40° F their ability drops off and all but ends at freezing temperatures. The normal-temperature battery drain of the F3 is quite low, thanks to the LCD panel which uses only about 1/5 the amount of power of an LED digital display. Power drain is about 5 milliamps while the shutter requires some 17 milliamps. Compared to the Nikon FE, the Nikon F3 requires slightly more battery power. In normal use the batteries are supposed to last about a year, but it's been our experience in all SLRs that life is considerably shorter than that—and the more the camera is used, the shorter the battery life tends to be.

With all previous electromagnetic-shutter-release SLRs, dead batteries mean no camera operation. However, the F3 has a backup mechanical shutter release lever concentric with the exposure memory lock button. When pressed, it releases the shutter at a mechanical speed of 1/60 sec. whether batteries are operating or not. It



also operates on the "T" setting for long exposures. While the meter will not be working under these circumstances, at least the owner can use the camera at any aperture he wishes with the 1/60 sec. or "T" settings.

With the professional in mind, Nikon has gone further. Once the MD-4 motor drive is attached to the camera, the eight AA cells or nicad pack in the drive take over the powering of the camera's metering system and shutter. Although alkaline energizers function best between 32° and 100° F, they can operate down to -20° F, losing about 2/3 of their capacity. For photographers often working in low temperatures, Nikon has made available a nicad battery pack which replaces the 8 AA cell clip and can operate at -20° with greater facility.

Since many pros keep motor drives on their camera at all times—and the MD-4 motor is exceptionally small and light, a bit larger than some auto winders—Nikon has gone far to obviate battery failure for those who can afford it least—the professionals. Serious amateurs can do likewise, or carry extra, warm batteries. (We'll get to a more detailed analysis of the motor drive system later.)

The Nikon F3, as we've explained, is one of the few SLRs offering through-lens autofocus exposure measuring. All SLRs with any dedicated flash systems whatsoever have located the contacts for the special flash units within a hot shoe atop the prism. This would not prove feasible for the Nikon F3, since an interchangeable prism would make such an arrangement less than rigid and stable. Nikon elected instead to maintain their own type of accessory shoe at the base of the rewind knob and to locate the flash connections there. Such a placement isn't new for Nikon. Both the F and F2 had similar accessory shoe placements, but the F3 shoe platform is slightly wider and therefore not compatible with that of the F and F2. (An accessory coupler will be available, however, to allow F and F2 flash units to fit the F3 for regular non-coupled flash operation.)

Two specially coupling flash units have been made for the Nikon F3. The SB-12 flash is a four-AA-cell unit, rectangular in shape and similar in outer dimensions to other Nikon flash units made for the F2 and FE cameras. It's 1 1/2 in. high, 4 in. long and 3 3/4 in. deep. The unit's swivelling foot slides backwards over the rewind knob of the F3. You then turn the outer foot collar of the flash unit clockwise, locking the unit in place. In our opinion, it locks more securely than any hot shoe unit atop any prism. The foot has three electrical contacts which connect with three at the front of the camera's hot shoe. The ASA set on the camera's film-speed dial is keyed into the flash mechanically by a lug attached to the ASA setting ring. The lug makes contact with a spring loaded finger inside the flash unit's locking collar. Although the camera's ASA setting range extends from 12 to 6400, the flash unit's only goes from ASA 25 to 400.

With the SB-12 flash unit turned on and the switch at the back set on A for automatic operation, a red flash ready LED will light within the finder in 8 sec. If it blinks instead of remaining steady, the ASA set is beyond the 25-400 range or the flash unit isn't attached to the camera correctly.

## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                                           | As Tested                                         |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                                        |                                                   |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                     | 39 in. (1.0m)                                     |
| Apparent distance of shutter-speed scale | Between 2m (79 in.) and 0.7m (28 in.)                                                                                                  | 51 in. (1.3m)                                     |
| Apparent distance of aperture scale      | Same as above                                                                                                                          | 31 in. (0.8m)                                     |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                              | Vertical: 98%<br>Horizontal: 99%                  |
| Parallax error compared to film          | Vertical: 0.24mm<br>Horizontal: 0.18mm                                                                                                 | Vertical: 0.2mm (up)<br>Horizontal: 0.1mm (right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                  | No discrepancy                                    |
| Image magnification                      | 0.8X ± 0.1X                                                                                                                            | 0.78X                                             |
| <b>PICTURE SIZE:</b>                     | 24 ± 0.6mm x 36 ± 0.9mm                                                                                                                | 24.2 x 36.2mm                                     |
| <b>SHUTTER:</b>                          |                                                                                                                                        |                                                   |
| Curtain travel evenness                  | ± 0.33 stop                                                                                                                            | 0.07 stop                                         |
| Camera insulation from sync              | More than 7 megohms                                                                                                                    | Infinity                                          |
| Sync contact efficiency                  | More than 60%                                                                                                                          | 95%                                               |
| Synchronizer delay time                  | X: within full opening                                                                                                                 | Okay                                              |
| Shutter curtain bounce                   | Not allowed                                                                                                                            | None                                              |
| Self-timer delay time                    | 7-15 sec.                                                                                                                              | 10 sec.                                           |
| <b>LENS:</b>                             |                                                                                                                                        |                                                   |
| Focal length                             | 50mm ± 5%                                                                                                                              | 50.5mm                                            |
| Maximum aperture                         | f/1.4 ± 5%                                                                                                                             | f/1.40                                            |
| Distortion                               | ± 2.5%                                                                                                                                 | less than 1.0%                                    |
| <b>CAMERA SIZE:</b>                      | Body: 5 1/8 in. wide, 3 13/16 in. high, 2 9/16 in. deep (149.2 x 97.0 x 65.5mm) Lens: 2 1/2 in. diam., 1 9/16 in. long (63.7 x 39.8mm) |                                                   |
| <b>WEIGHT:</b>                           | Body: 25 oz. (708g) with DE-2 finder and batteries<br>Lens: 9 oz. (255g)                                                               |                                                   |

When the flash unit is recycled, it automatically sets the camera to the correct X-sync speed of 1/80 sec. except at manual speeds of 1/30 sec. or lower where you might wish to use these slower speeds for combined existing light and autofocus.

Press the shutter release and the lens will close down to your pre-selected aperture. The camera's metering circuit will provide just the proper flash duration for correct exposure. If there has not been sufficient light for the exposure, the red LED will blink afterwards. If there has been enough light the unit will recycle and show the constant red LED when ready to fire again. A large dial atop the flash unit indicates the approximate distance ranges possible with each lens aperture and ASA index, so you can check it before you shoot.

The SB-12 provides upwards of 160 flashes per set of batteries (the closer the subject and larger the aperture, the more flashes, as in all energy-saving flash units). With ASA 25 film and an f/2 lens, the SB-12 has a range from about 3 to 20 ft. With ASA 400 film the range is upwards of 60 ft. Using small apertures the flash can be operated as close as 20 in. Regrettably, our ability to

test the flash system was limited by the unavailability of the promised TTL connecting cord which will allow you to remove the SB-12 from the camera and place it wherever you want for off-camera, angled, close-up or slide duplicating flash.

The SB-12 normally covers the angle of a 35mm lens adequately with slight edge fall-off, but an accessory wide-angle adapter widens the beam angle to accommodate the angle of a 28mm lens. The unit can also be used manually. Its guide number is then 42 for ASA 25 and 160 for ASA 400 films. All guide numbers and autofocus distance ranges are slightly less when the wide-angle adapter is used. There appears to be no present plan to make an adapter allowing the SB-12 flash unit to be used on cameras other than the F3. In any case, it would have to be operated in the manual flash mode only if it were adaptable to other cameras. The SB-12 can be used off-camera manually, since it has a standard PC connection at the rear and can therefore be attached to the F3's PC terminal on the left front of the camera. Of course, you lose all autofocus features when it's used in this manner.

In addition to the SB-12, Nikon has



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created the SB-11 (\$290), a more powerful head-and-handle electronic flash unit with bounce head and eight-AA-cell capacity, which fastens to the camera via a bracket attached to the tripod socket. While it can be operated on cameras other than the F3 (since it has its own built-in sensor and accessory sensors), the TTL cord for this unit (which attaches over the rewind knob) was also unavailable at testing time. We thus decided to await the cord before reporting further on this unit.

While the metering system for continuous light has an 80 percent center-weighting within the 12mm finder measuring circle we were curious just what measuring area the cell used for electronic flash. Most sensors on autoflash units measure about 20 percent no matter the focal length of the lens used on the camera which, as we have explained in articles on autoflash, can lead to serious exposure errors. Our check of the F3 meter's flash sensitivity area indicated a pronounced center-weighting. The measuring area is in the form of a horizontal oval about 8mm high and 24mm long in the center of a 24 x 36mm frame. This should certainly contribute to far less error in auto exposure than the narrower beam of sensors built into most flash units. Of course, the F3's flash measuring covers the same area whether used with wide angles, normal or tele lenses, so you can easily determine whether your subject is within the measuring area.

The F3's through-lens measuring flash system as designed seems up to the best possible with today's technology. As with all through-lens metering flash units, we do wish there was a signal indicating overexposure when shooting close-ups, but no camera or flash system has such as yet.

We are now ready to examine the MD-4 motor drive. After the massiveness and complicated features of the MD-1 and MD-2 motor drives for the Nikon F2, it is hard to take the MD-4 for the F3 seriously. Adding but 2 7/16 in. in height and 25 oz. (with nicad pack) to the F3 (thanks largely to the use of micro-electronic circuitry not available when the F2 motors were designed), it resembles a winder more than a professional motor. But the MD-4 (\$380) has all the specifications for a pro motor, including speeds up to 6 fps and motor drive rewind plus many remote-control possibilities. How well it lives up to them, we'll soon see.

The motor consists of a horizontal base with battery compartment and controls plus a vertical grip handle with control dial and electromagnetic release button. The battery clip, included, can be removed easily and almost instantaneously by sliding a small release catch on the right side of the motor. The plastic battery clip holds eight AA cells. (The MD-1 and MD-2 for the Nikon F2 required 10 cells in two separate battery compartments.) The spring coil terminals which hold the battery ends in place can be a little tricky to deal with and can be squashed to the side if you aren't careful to insert the batteries away from the springs and only then press the ends against the springs. (Oddly the shorter, tighter coil springs on the MD-11 motor for the Nikon FE are easier to deal with.)

The alternate portable power source is the MN-2 Nicad battery unit (\$107) and its

MH-2 Quick Charger (\$129). Using it, rather than AA cells, is a delight—not only in loading but also in performance, as we'll see. The MN-2 is an enclosed battery pack block which slips right into the end of the motor drive. The 4 3/4 x 2 7/8 x 2 1/2-in., 19-oz. charger is supplied with either a 220-volt or 110-volt AC cord (or both if you need them) and a permanently-attached, 6-ft. charging cord and plug. The MN-2 Nicad battery unit is charged by taking it out of the camera and plugging it into the charger. A green light on the charger glows when charging starts. When it's complete, a red light appears. Total charging time, according to our tests, is between two and three hours depending on how pooped the Nicad battery is.

To attach the motor to the F3, you unthread a cover on the bottom of the F3 which protects the rewind shaft. Why a cover for the rewind shaft? Because the MD-4 motor, like the MD-1 and MD-2 motor for the F2 camera, provides motor drive rewind. The motor's rewind keying drive must enter the bottom of the F3 to make contact with the slotted key mechanism within the film-cartridge spool end. (Both the battery clip and Nicad pack have a neat spring-loaded storage compartment for the rewind shaft cover complete with ribbed releasing latch.)

In order to avoid the necessity of a removable cover, couldn't Nikon have devised an in-camera mechanism to key to the film spool and then used a bottom of camera key to attach to the motor? It's possible, but this would have complicated loading film into the film chamber, would have added an additional moving element between motor and film and, of course, would have sent the cost upwards. Probably the first point is most salient.

If there's a big hole in the bottom of the camera central to the film spool isn't there danger of the film being fogged if you decide to attach or remove the motor drive mid-roll? Some danger, yes, but only if the change is made in very bright light or the shaft is left open for a considerably time. The Nikon engineers have learned from the MD-1 and MD-2 motors, where light literally streamed into the camera when the motor was removed. In the MD-4, the film-cartridge spool end presses against a spring-loaded collar. This collar prevents subdued illumination from reaching the film chamber and film. We found that a quick change to or from the motor when carried out indoors or in shaded light outdoors did not cause any film fogging. However, Nikon (and we) do advise putting the motor on or taking it off before film loading whenever possible.

Besides keying to the film spool, the rewind mechanism platform of the motor has six spring-loaded gold-plated electrical contacts. A seventh pin has been removed. Our query to Nikon concerning it brought the reply that the engineers had needed the extra pin on prototype motors but no longer did, and it was more trouble to remove it than to shear it off. The motor fits the F3 snugly after you fasten it to the camera tripod socket with the large, well knurled mounting screw knob that protrudes at both the front and back of the MD-4.

When attached, the motor forms virtually a contoured integral part of the camera, cleverly angling forward so camera and

motor can stand firmly on a level surface and not pitch forward on its face like many another camera and motor. Interestingly, only one other SLR has adapted the same forward angling—Nikon's least expensive camera, the EM, with its autowinder.

The vertical winder grip (which Nikon calls "anatomical") has finger contours and studded, grippable surfaces to provide good comfort and convenience. Unlike the forward-angled released button on the MD-1 and MD-2 for the F2, the MD-4 has its release button directly atop the grip, which some users may not find as handy. We had a tendency to press the release with the edge of a finger rather than the ball. Undeniably it will simply be a matter of getting used to it. If you'd rather use the shutter release on the camera body, you can do it—but for single shots only. It will not operate for continuous bursts. If you do use the camera's release, the motor will wind only after you remove pressure from the release. When you use the MD-4 release button, the film is advanced immediately.

Irrespective of angled vs. non-angled release discussions, everyone will find the camera and motor combo easy to hold and handle, even with one hand and ideal with two—really no more difficult than other cameras with simple winders. But the MD-4 beats winders and motors on all other cameras and does it easily. The ring around the release button has three positions for lock, single shots and continuous run. At the back of the motor are a number of indicators and controls. Two LEDs serve as a battery check. When both light, you have over 50 percent power capacity, approximately. When only one lights, you are below 50 percent capacity approximately. When none light, your batteries have had it. One diode also lights during auto winding and remains on when the end of the film has been reached.

A frame counter indicates the number of frames you have left to shoot—if and when you want to use the counter. Turn the recessed knurled setting wheel until the orange dot appears in the counter window and you can override the frame counter. Set any specific number of frames 1 to 36 and the motor will automatically halt after the specified number of frames have been shot, whether in continuous or single-shot mode. When you finish the roll, push sideways on the right-hand part of the rewind lever. This presses in the camera's rewind button. Slide the left-hand rewind lever upwards and film rewinds by motor completely into the film cartridge. (If you prefer the film leader to remain outside the cartridge, you'll need the accessory MF-6 camera back [\$76] which cuts off power when the leader is still outside the cartridge.)

So much for the gee-whiz specifications. How does it all work? In our tests, every function matched expectations and specifications. With AA alkaline energizer cells, Nikon promised 3.8 frames with the rapid return mirror operating so you can view and focus, and 4 with it locked up. (In the mirror-up position, you must use the camera on manual shutter speeds.) In our tests, made with film in the camera, we calculated speeds of 3.82 and 4.18 respectively. With the Nicad battery unit, we really flew. Nikon listed speeds of 5.5 and 6 fps. We hit 5.6 and 6.1. In rewind, AA cells rewound a



36-exposure roll in 8 sec. while the Nicad pack cut it down to 4.7 sec. Whew! (Warning: In cold, dry weather, use of the motorized rewind may cause static electricity marks on the film. You must, instead, rewind by hand. With the motor attached, we found this can be a more pesky business since there is considerable drag caused by the motor rewind mechanism—like putting the top up on a motorized convertible car—but by hand.)

We were not able to test the MD-4 AC/DC converter, which will be available for those who would rather run the motor from a standard household or studio outlet. However, we did try to beat the game using eight Nicad AA cells in place of the eight alkaline energizers to see whether we would get performance closer to the Nicad pack unit. Performance was poorer than with regular AA alkaline cells. It's not too surprising since the Nicad battery unit packs 16.8 volts, whereas eight AA cells alkaline energizers have 12 volts and eight Nicads have but 10 volts.

Nikon specifies that the fully charged Nicad battery unit can drive 60 rolls of 36 exposures through the camera at the speeds given and 10 more at reduced speed. We tired after running through 50 but can vouch for speed maintenance. With alkaline energizers 60 rolls at speeds given are promised, with 80 more at reduced speeds. We'll vouch for 62 at top speed but we didn't take the test further than that. Since Nikon has been right on target with its other specifications, there's ample reason to suspect you would reach a 140-roll total with a really fresh set of batteries. However, since it's doubtful that many photographers would shoot 140 rolls per film at one session and since batteries do deteriorate with age and when not removed from the camera (if not used often), we doubt if its really practical to try for 140 in tests. Results from any reader wishing to report on success or failure will be welcome.

You can use the much less expensive zinc carbon batteries instead of alkaline energizers. These will also give you 60 rolls at top speed, plus 40 more at reduced speed. With the vast difference in expense between alkaline and zinc carbon, zinc carbon would certainly seem more than adequate for most photographers.

The MD-4 far outdistances the MD-1 or -2 for the F2 camera, which only guaranteed 80 rolls total with alkaline energizers or 60 total with to Nicad units. The only feature which photographers may miss on the MD-4 is the variable firing speeds of the MD-1 and 2 which provide speeds of 1 to 5 fps set by dial. The MD-4 operates only at top speed at camera speeds of 1/125 sec. or over. At slower camera speeds, firing rate depends on the shutter speed. Top speed with mirror locked up on the MD-1 or -2 is 5 fps.

The MD-4 has terminals for remote control, external power and connection with a magazine back. We regretted the placement of the tripod socket on the far left rather than in the center. However, the battery chamber makes central placement impossible.

Taking into consideration the motor's ability to guarantee power for the camera meter and shutter, its compactness, convenience, and the businesslike way it blazed through all our field tests, we give it

top billing for desirability. For amateurs, the AA battery clip will probably deliver sufficient fps, but we can't imagine pros not having one Nicad pack in the camera and one in reserve. Noise level? The old MD-1 motor checked in at 66 db, while the new, quieter MD-4 measured 64 db. At 1/125 sec. the shutter noise of the F3, on the other hand, is infinitesimally greater than that of the F2—64 db versus 63 db. In short, for all practical purposes, both cameras are quieter than average.

Did the motor designers slip up somewhere? Well, yes. The motor grip covers the self-timer LED. Perhaps you won't be using the motor/self-timer combination often, but we did come across a feature to make up for the minus. If you put the MD-4 on continuous firing and use the self-timer, the motor and self-timer act as an intervalometer, automatically making exposures every 10 seconds as long as you keep pressure on the release. Now there must be some good use for that.

In making our practical field tests with the F3, we were concerned about a number of warnings which appear in the F3 instruction book. The one that concerned us most lists the auto-exposure range possible based on its ASA 100 EV 1 to EV 18 exposure range. It's considerably more abbreviated than that of other SLRs we have tested. (The Olympus OM-2N, for instance, goes down to -6.5 EV!) The range limitation listed by Nikon indicates a slowest possible speed with ASA 100 film of 1 sec., and 1/4 sec. with ASA 400 film. However, as with other Nikon cameras we have tested in the past, we feel the range warning can be exceeded in practice with impunity. With ASA 400 film we were able to get accurate readings in our practical film test down to 8 sec., and we exceeded the Nikon warnings similarly at other high ASA speeds. Cameras may vary in their abilities, so we'd suggest you check out your own camera if slow shutter speeds are to be required at high ASA index films.

Nikon warns that at temperatures below 14°F (-10°C) the LCD panel may get a bit sluggish and exhibit a slight delay in providing shutter-speed information. This is correct, but the camera does continue to function with near-immediate meter action as far as the actual exposure is concerned. The delay on the LCD panel proved to be very minute. We did test the F3 and Nicad battery pack at 0°F and found the camera operated properly as specified.

We didn't try to check Nikon's warning at the other end of the scale—that at temperatures of 140°F the surface of the LCD panel may turn black and be illegible but would return to normal with the temperature. At 140°F most of MODERN's testers tend to black out and become illegible too. Nikon further warns, however, that prolonged exposure to such temperatures can damage the LCD so this, like other cameras, should not be left in the hot sun or in any car trunk with the sun blazing down upon it.

Nikon's last warning is that the LCD panel only has a life expectancy of 6 or 7 years, after which it loses contrast and becomes hard to read. Nikon promises, however, that the fee for replacement will be nominal.

So much for the warnings. The F3 performed admirably in all its field tests—indoors, outdoors, in daylight, with flash. We

particularly like the ease with which we could read both shutter speeds and apertures in just a quick glance since they appear as numerals right next to each other. The LCD panel is a delight. You will note a slight darkening of the panel background when the lens metering prong passes in front of the light-gathering window. If it does annoy you, have the prong removed if you don't need it with older cameras. We did prefer the increased central weighting of the meter which all testers—and other photographers queried—felt gave all of us better knowledge of just what was being measured and consequently better control over the exposures. The motor was a hit with everyone—amateur and professional alike. Our test slides were of a quality to reflect the splendid shutter-speed and exposure accuracy revealed by our lab tests.

You might wonder why Nikon did not provide shutter-speed-preferred or programmed exposure automation. First, for pros using mirror teles and non-coupled optics, aperture-preferred automation is necessary. Adding shutter-speed automation would have complicated camera design and construction and might thus have lessened reliability. Secondly, adding other exposure automation modes would have required changes in the Nikon lens mount—changes which Nikon is reluctant to make in view of long term commitments to its present lens owners.

Structurally, the Nikon F3 has been built to the best professional standards. The body casting is in two parts, front and rear. After peeling the leather from the right and left front panels, we reached eight screws which hold the two castings together. Seven wires connect the front (which consists basically of the mirror box, faceplate and lens mount, memory hold button and self-timer LED) with the rear section (which has the shutter and wind mechanisms plus the flexible circuit board). Once the front is removed, it is an easy matter for a repairman to work on the camera's main operational parts.

The F3, we were told, has about 1/3 fewer parts than the F2. An examination of its interior confirms that there are fewer parts, although we did not attempt to disassemble an F2 and F3 completely down to the last screw to check Nikon's statement.

All mechanical switches, a problem area in electronically-controlled cameras were made of heavy gold-plated metal. There were fewer than we had expected. Electronic circuitry has evidently reduced the need for them. The wind mechanisms and shutter curtain drum have large multiple ball-bearing raceways which accounts for much of the camera's smooth action and should contribute to the F3's longevity in heavy use.

In summary, our interior examination leads us to believe that Nikon has put their engineering to the test—to build a rugged, reliable pro camera.

We did have some questions concerning the F3 that we could not answer. Why had Nikon elected to measure only flash from the film and not measure continuous illumination as well as had Olympus? Nikon's answer was in part that measurement off the first shutter curtain and film for continuous light was a patent belonging to another company. However, we think additionally that the 80 percent center-weighting of the



## 35MM Single Lens Reflex

F3 metering circuit would be very hard to duplicate and maintain if the meter had to read the film and/or the first shutter curtain depending on shutter speed. The Olympus meter sensitivity pattern is not as center-weighted and it does change with shutter speed, depending on whether the cells are reading the film and/or the shutter curtain.

We were also curious about Nikon's estimate of how rugged the F3 camera was. In terms that pros understand, minimum picture cycles before breakdown, just what was Nikon aiming at? We asked—and got an answer. The minimum number of shots is about 150,000. With other Nikons now in the line about half that many can be expected as a minimum. Let's see, that's 4,166.66. 36-exposure rolls of film, and half that amount for other cameras. You can all now apply your own shooting requirements to this as see how long it will be, at a minimum, before your F3 would need looking into. You should be shipping your camera in for a CLA (cleaning, lubrication and adjustment) every three years or so as an amateur or every year as a pro, which would be long before that number 150,000 comes up.

We feel that for the Nikon enthusiast the F3 represents a perfection in design, ability, construction, enjoyment and handling never before achieved. The LCD shutter-speed readout is superb.

**Optical bench analysis:** On axis at f/1.4 the 50mm Nikkor showed a slight orange flare and very slight spherical aberration both of which were greatly reduced by f/2. All axial aberrations were virtually gone by f/5.6. Off axis, very slight red-blue lateral color and very slight high order coma were present. The coma was almost gone by f/8.

**Field test slides:** Our pictures showed flare to be extremely well controlled throughout. A slight softness was noticeable in scenes taken at f/1.4, but this improved at f/2 and our slides were very crisp and snappy by f/4. Overall, we'd rate this field performance as very good to excellent. (June 1980)

### RESOLUTION

| Nikkor 50mm f/1.4<br>no. 4023594<br>at 1:49 magnification |                    |    |                    |    |
|-----------------------------------------------------------|--------------------|----|--------------------|----|
| f/no.                                                     | Center<br>Lines/mm |    | Corner<br>Lines/mm |    |
| 1.4                                                       | V. Good            | 49 | Excellent          | 35 |
| 2                                                         | V. Good            | 55 | Good               | 39 |
| 2.8                                                       | Good               | 62 | Good               | 49 |
| 4                                                         | V. Good            | 69 | V. Good            | 55 |
| 5.6                                                       | Excellent          | 78 | Excellent          | 69 |
| 8                                                         | Excellent          | 78 | Excellent          | 69 |
| 11                                                        | Excellent          | 69 | Excellent          | 69 |
| 16                                                        | V. Good            | 62 | Excellent          | 55 |

### CONTRAST

| Nikkor 50mm f/1.4<br>no. 4023594<br>at 30 lines/mm |          |    |          |    |
|----------------------------------------------------|----------|----|----------|----|
| f/no.                                              | Center % |    | Corner % |    |
| 1.4                                                | Medium   | 51 | Medium   | 24 |
| 2                                                  | Low      | 52 | Low      | 24 |
| 2.8                                                | Low      | 60 | Low      | 35 |
| 4                                                  | Medium   | 65 | Low      | 42 |
| 5.6                                                | Medium   | 65 | High     | 58 |
| 8                                                  | Medium   | 64 | Medium   | 55 |
| 11                                                 | Medium   | 60 | High     | 50 |
| 16                                                 | Low      | 55 | Medium   | 45 |

## NIKON N4004: MORE THAN A P&S AF SLR

### MANUFACTURER'S SPECIFICATIONS:

**35mm TTL, phase-detection autofocus, multi-mode SLR, built-in pop-up flash. Body No. 2045798. LENS: 50mm f/1.4 AF Nikkor in Nikon interchangeable bayonet mount. SHUTTER:**

**Electronically controlled hybrid, metal and plastic blade, vertical travel, stepless speeds from 1-1/2000 second in program and aperture-preferred modes, discrete speeds from 1-1/2000 second shutter-preferred and manual modes; electronically controlled long exposures long exposure at B setting, 1/100 second at X sync. EXPOSURE SYSTEMS: Three-section SPD cell above eyepiece provides three-zone auto-compensating multi-pattern readings in autoexposure modes, from EV 2-19 at ISO 100, centerweighted pattern in metered manual mode or with AE lock engaged. Program mode provides normal exposure program at focal lengths to 135mm, automatically sets high-speed program at longer focal lengths; shutter-preferred, aperture-preferred and metered manual; DX-only film speed setting for films ISO 25-5000; non-DX films keyed in at ISO 100.**

**FLASH: Built-in TTL flash provides program autofocus in program and shutter-priority modes, normal TTL autofocus in other modes; auxiliary program and normal TTL autofocus via four-pin dedicated hot shoe.**

**VIEWFINDER: Fixed eye-level pentaprism with non-interchangeable clear matte screen having central autofocus brackets, circle defining centerweighted metering area. LED-transilluminated symbols provide exposure and flash information (see text); green focus OK LED works in AF and manual focus modes. OTHER FEATURES: Autoloading, single frame auto wind, power rewind, single servo AF or manual focus; shutter locks when AF not possible, exposure out of range or flash not recycled; electronic self-timer with LED, film winder indicator.**

**BATTERIES: Four alkaline or nicad AA cells power all operations. PRICE: \$681.50 with 50mm f/1.4 AF Nikkor, \$504 with 50mm f/1.8 AF Nikkor.**

What manner of autofocus SLR can succeed in enticing point-and-shooters into the realm of serious photography? Nikon's answer is the N4004, a handsome, hefty machine with a combination of features unabashedly aimed at beginners, but also with sufficient metering and control options to allow them to grow into intermediate and advanced photographers.

With the possible exception of *real f/stop* and shutter-speed dials on top (either or both of which can be easily set to provide a total of three autoexposure modes), the 4004's controls are unimposing, and its comprehensive automation assures that those who don't wish to "study photography" will have precious little to learn in order to get the best out of this camera.

Although it is, relatively speaking, a

moderately priced AF SLR, the 4004 incorporates the now standard complement of features, including easy loading, auto wind, power rewind and dedicated autofocus capability. It's the second AF SLR to have a nonremovable built-in autofocus hinged atop the pentaprism housing (the Pentax SF1 was the first). This small, effective unit provides programmed and normal auto TTL flash plus balanced flash fill in daylight (as do the Nikon SB-22 and SB-20 shoe-mount units specifically dedicated to the 4004). Advanced amateurs will appreciate the AE lock (exposure-hold button) and straightforward system of manual metering, both of which automatically switch in the camera's optional centerweighted metering pattern.

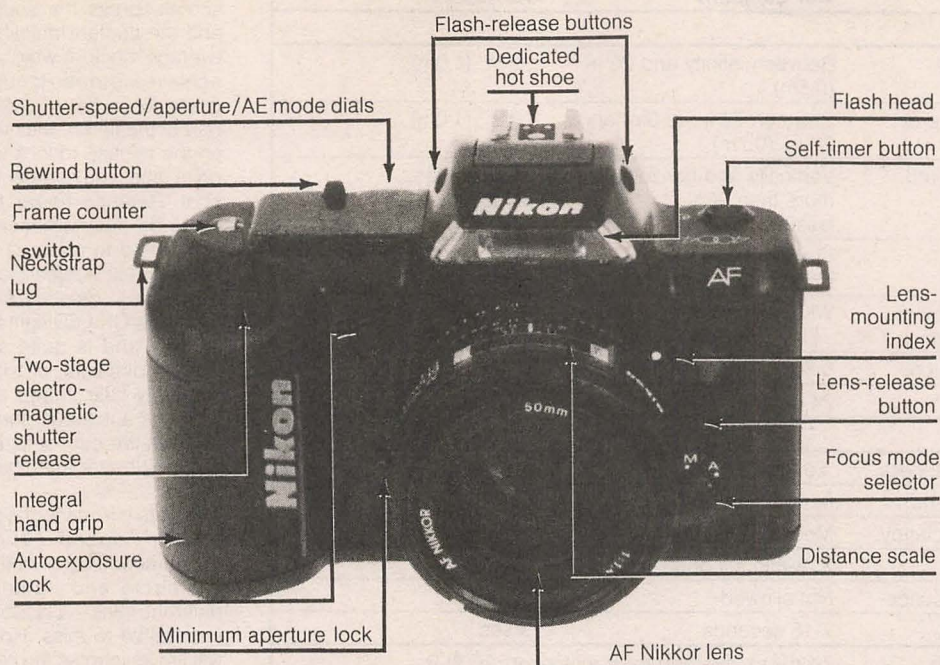
Like the N2020, Nikon's first broad-spectrum AF SLR, which continues in the line, the N4004 accepts all AF Nikkor lenses (except the 80mm f/2.8 and 200mm f/3.5 specifically designed for the Nikon F3AF). This AF-Nikkor lens line presently ranges from 24 to 300mm and includes five zooms. Since the venerable F-mount has been retained, you can also mount and focus virtually any manual focus AI, AI-S or Series E lens on the 4004—but you can't meter them via the camera, and you can't autofocus them using a TC-16 or TC-16A autofocus converter. You can do either or both on the N2020, which is why the N2020 makes more sense for those who wish to add an autofocus SLR to an extensive Nikon system.

Despite the 4004's close ties to the entry-level SLR sector, it is far from a stripped-down economy model. In fact, it incorporates some useful high tech features not found on the more expensive N2020. In the camera's base, at the bottom of the mirror box, is a solid optical block that relays a percentage of the light passing through the lens to the AF system's 200-element CCD sensors. The solid glass block directs the light more efficiently and precisely since it minimizes the refraction present with other light-transfer systems. The new AM-200 CCD sensor incorporates more elements than competitive systems for claimed improvements in focusing accuracy, particularly with subjects having fine detail and/or low contrast. Furthermore, the individual CCD elements are angled slightly off the vertical axis for better performance with subjects having horizontal or vertical lines. Nevertheless, the clear, concise instruction booklet recommends focusing manually or on a substitute subject when shooting a "subject with no vertical lines."

Yet another advanced feature is the Triple-Sensor Metering System, a slightly simplified version of the five-zone Automatic Multi-Pattern metering system Nikon pioneered in the Nikon FA. Select any one of the camera's autoexposure modes—program, aperture-preferred or shutter-preferred—and this system evaluates the light from three separate areas of the picture (roughly, right, left and central circle) and disregards the light level in a band along the top of the picture field. The camera's microcomputer then classifies the light pattern into one of several groups stored in memory and sets the correct exposure. If the light level falls



## What's New at a Glance: Nikon N4004



below EV 10 at ISO 100 or if the central reading falls at least one EV below the background reading at higher light levels, the lightning bolt readylight in the finder blinks to recommend that you use flash. If you elect to do so, the camera will provide balanced TTL fill flash, which controls the exposure of the main subject and the background so that (when possible) both are correctly exposed.

Now that you have a basic idea of what the 4004 is and what it can do, let's take a closer look at the camera itself. Like most of its rivals, it's somewhat larger and heavier than the average non-AF SLR, but its polycarbonate outer body is conservatively stylish and its rounded contours are pleasant to look at and convenient to hold. On its right side is a largish but very comfortable grip surmounted by a well-placed, angled shutter release. The grip looks large enough to hold the four AA cells that power all camera functions, but it doesn't. Turn the camera upside-down and flip up the clearly marked, hinged battery compartment cover on the bottom and you'll see that only two of the batteries stand vertically in the grip—the other two lie along the bottom. Note also that the tripod socket is centrally placed, a convenience not found on a fairly large percentage of contemporary SLRs.

To check battery power, gently press the smooth two-stage shutter release while you look through the finder. If one or more indicator LEDs light and stay on for eight seconds after you take your finger off the button, you have sufficient battery power.

With the lens off the camera, you can see that the 4004 chromed steel Nikon mount is affixed to the body with five screws. Near the bottom of the mount, toward the right side of the camera, are the AF coupler (which connects the AF motor in the camera to the focusing mount in the lens) and the minimum aperture lever, which signals the metering system

whether or not the lens is set to minimum aperture (as it must be to use *any* metered mode). Just inboard of the upper edge of the mount is an array of seven gold-plated electrical contacts, which mate with the five spring-loaded contacts found on the backs of AF Nikkor lenses (presumably two contacts are held in reserve for future use). Aside from these differences, the mount is a dead ringer for the F-mount Nikon introduced on the original Nikon F nearly 30 years ago—a striking example of non-obsolence.

To mount an AF Nikkor, align its aperture/focus scale index line with the white dot lens-mounting index on the lens surround, seat the lens and turn it about 60 degrees counter-clockwise until it clicks. Now turn the aperture ring to the minimum aperture (its digits are orange) and lock it in place by pushing in and turning a small aperture lock button on the right-hand side of the lens barrel so that its white dot coincides with an orange index line. The lens should be locked at its minimum aperture even if you plan to use aperture-priority or manual-metering modes. Once the lens is mounted, you change apertures by turning the aperture dial on the body—it overhangs the rear edge of the top of the camera, to the right of the prism housing. The aperture-lock button is small and "fiddly," but fortunately you seldom use it.

To load the 4004, push down the recessed back lock on the left-hand side of the body and swing the back open to the right. The interior is nicely finished, with a metal film-aperture plate having super-smooth film guide rails, and a film cartridge chamber adorned with 12 gold-plated DX contacts and a flat cartridge-positioning spring. To load film, hook the flat end of the cartridge over the film-rewind shaft, seat the cartridge and pull the leader out to the orange film leader index. Now close the camera and press the shutter release all the way in while observing the film-advance indicator in a

little oval window on the right-hand side of the back. If it rotates, and the frame counter on top advances from S to 1, you're properly loaded. However, the 4004 is a DX-only camera—there is no way to set film speeds manually (non-DX cartridges are keyed in at ISO 100) or to alter the standard DX-keyed ISO settings. Unlike other AF SLRs, it doesn't even display the camera-set ISO on its LCD panel as the film winds to number 1—in fact, the 4004 *has* no LCD panel! Thankfully, DX indexing problems are quite rare (providing you keep your cartridges and DX contacts clean) and few films require that you set ISO settings other than the standard ones. Photographers who wish to achieve special effects with exposure are free to meter manually or use the AE lock.

As we've implied, the 4004's metering system is simple but sophisticated. All major functions are controlled by two small but clearly marked dials atop the camera that are housed under a clear plastic panel labeled Decision Master System. The knurled edge of the shutter-speed dial hangs over the angled front of the camera top. It has click-stopped settings from 1/2000 second plus A (aperture-preferred AE), L (shutter release locked, power off) and B (bulb). The dial overhanging the rear is the aperture dial. It's click-stopped at half-stop intervals from f/1 (marked with a dot) to f/32 and has an S setting denoting shutter-preferred AE. Set these dials so that A and S respectively appear under the oval index and you'll get programmed autoexposure. Mount an AF Nikkor lens shorter than 135mm and you'll get the normal program which, over most of its range, provides faster shutter speeds and smaller apertures in uniform amounts as the light level increases. Use a longer AF Nikkor and you'll automatically get the camera's high-speed program, which is biased toward selecting faster shutter speeds at any given light level.



## GENERAL PERFORMANCE

| Checkpoints                           | Our Standard                                                                                                                                                                                                                                                  | As Tested                                        |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <b>FINDER:</b>                        |                                                                                                                                                                                                                                                               |                                                  |
| Apparent viewing distance             | Between infinity and 20 in. (0.5m)                                                                                                                                                                                                                            | 39 in. (1.0m)                                    |
| Apparent distance of LED indicators   | Between 79 in. (2.0m) and 26 in. (0.7m)                                                                                                                                                                                                                       | 39 in. (1.0m)                                    |
| View area compared to film area       | Vertically and horizontally more than 90%, less than 100%                                                                                                                                                                                                     | Vertical: 93%<br>Horizontal: 92%                 |
| Parallax error compared to film       | Vertical: 0.8mm<br>Horizontal: 1.4mm                                                                                                                                                                                                                          | Vertical: 0.1mm (up)<br>Horizontal: 0.6mm (left) |
| Focusing accuracy at maximum aperture | Within depth of focus                                                                                                                                                                                                                                         | No Discrepancy                                   |
| Image magnification                   | 0.80X±.1X                                                                                                                                                                                                                                                     | 0.80X                                            |
| <b>PICTURE SIZE:</b>                  | 24 ± 0.6mm x 36 ± 0.9mm                                                                                                                                                                                                                                       | 23.9mm x 36.3mm                                  |
| <b>SHUTTER:</b>                       |                                                                                                                                                                                                                                                               |                                                  |
| Curtain travel evenness               | ±0.33 stop                                                                                                                                                                                                                                                    | 0.11 stop                                        |
| Insulation from sync                  | More than 7 megohms                                                                                                                                                                                                                                           | Infinity                                         |
| Sync contact efficiency               | More than 60%                                                                                                                                                                                                                                                 | 78% (hot shoe)                                   |
| Sync delay time                       | X: within full opening                                                                                                                                                                                                                                        | Okay                                             |
| Shutter curtain bounce                | Not allowed                                                                                                                                                                                                                                                   | None                                             |
| Self-timer delay                      | 7-15 seconds                                                                                                                                                                                                                                                  | 9 sec.                                           |
| <b>CAMERA NOISE:</b>                  | 74 dB(a), average for a motorized AF SLR                                                                                                                                                                                                                      |                                                  |
| <b>CAMERA SIZE:</b>                   | Body: 7 <sup>5</sup> / <sub>16</sub> in. wide x 4 <sup>7</sup> / <sub>16</sub> in. high x 2 <sup>1</sup> / <sub>2</sub> in. wide (194 x 113 x 64 mm)<br>Lens: 1 <sup>1</sup> / <sub>8</sub> in. long, 2 <sup>9</sup> / <sub>16</sub> in. diameter (42 x 65mm) |                                                  |
| <b>WEIGHT:</b>                        | Body: 1 lb. 9 <sup>3</sup> / <sub>4</sub> oz. (733g) with batteries<br>Lens: 9 oz. (255g)                                                                                                                                                                     |                                                  |

How do you know you'll get a correct exposure in any of these autoexposure modes? By partially depressing the shutter release and observing the LED transilluminated display below the viewfinder screen! Like the rest of the camera, it is disarmingly simple, but remarkably comprehensive. Aside from the green focus OK LED, there are only four red, LED-lit symbols, but they tell you virtually everything you need to know. In the center is a tiny red circle with a plus sign on its left and a minus sign on its right. Off toward the right is a lightning bolt that provides flash info. Granted, there are no aperture or shutter-speed readouts in this finder, but we must confess we missed them only when using the aperture-preferred mode.

Here's how the system works. In all exposure modes, the circle lights up to confirm that the camera can deliver the correct metered exposure and blinks (at 1/30 second and slower shutter speeds) to warn of camera shake in all but manual-metering and shutter-preferred modes. In AE modes, either the plus or minus sign lights up if the light level is too bright or too dark, respectively, for autoexposure (an unusual occurrence, given the range of the exposure system). If the plus and minus blink alternately, you haven't set the lens to minimum aperture. In all three of these cases the shutter locks to prevent you from unintentionally taking a bad exposure.

To select metered manual mode, simply set both dials to numerical settings. You now fire the shutter at any time whether the indicated exposure is correct or not. Touch the shutter release and turn either or both exposure control dials until you see the red circle and you've set the correct

metered exposure to within 3 stop. If only the plus or minus sign lights, this indicates an overexposure or underexposure of more than one EV, respectively. If the circle and plus, or circle and minus sign light simultaneously, your overexposure or underexposure falls somewhere between one-third and one stop of the correct metered exposure.

All indications (including the flash indication) are easy to see at all times and the shutter-speed and aperture dials are well placed and very easy to manipulate with your forefinger and thumb respectively. However, we do wish that the dials had firmer detents at the autoexposure settings, A and S. On occasion we inadvertently turned the shutter-speed dial to L and wondered what went wrong.

The red LED-illuminated lightning bolt flash symbol below the right-hand side of the viewfinder also serves multiple functions. If it blinks (before shooting) when you press the shutter release, it's recommended that you use flash (or that you're using film faster than ISO 400, which is beyond range for TTL flash). This symbol also reappears to indicate the flash has recharged and blinks for a few seconds after you take a shot to warn you that flash power was insufficient to get the correct exposure.

All right, let's take some pictures. We'll presume that the camera is loaded, that the aperture dial of the standard 50mm f/1.4 Nikkor AF is locked at minimum aperture and that the focus-mode control below the lens-release button on the left side of the lens is set to A (autofocus). We'll start in program mode by setting the shutter dial to A and the aperture to S.

Bring the camera to eye level, place an important part of your subject in the AF brackets in the center of the viewing screen, press the shutter release lightly and the camera quickly focuses (with an average decibel whir) and stops when it achieves proper focus, indicated by a green focus OK LED below the left-hand part of the finder. Maintain finger pressure on the release to lock in the focus at that point and you're free to recompose the shot. Release finger pressure and the focus OK LED will immediately go out and you're free to refocus. Occasionally, with low-contrast subjects or in dim light, the camera will defocus and refocus before the focus OK LED lights, but it hardly ever "hunts" and is quite swift and decisive even in dim light, or with subjects having relatively little image detail. Overall, we judge its autofocus performance to be on par with the best of its competitors' and a slight bit better than that of the N2020 we tested.

If there isn't enough light for a hand-held shutter speed and the camera recommends flash, both the red exposure OK circle and lightning bolt flash at different rates—a double warning system impossible to miss. However, the shutter will fire as long as the camera can achieve proper focus. Under such circumstances the easiest way to get a properly exposed hand-held shot (providing your main subject is within its 14 foot range with ISO 100 film) is to activate the N4004's built-in flash. To do so, press both buttons on its sides at once and it will pop up and turn on. When the lightning bolt symbol lights continuously, the flash has recycled and you can take the shot. The flash recycles in four seconds with fresh alkaline AAs, swift for a non-lithium-powered unit.

In general, the performance of the 4004's built-in flash is outstanding—so much so that we shot nearly 50 percent of our field test pictures with the flash in its on position. It provides a pleasantly soft illumination compared to many shoe-mount units, covers the field of a 35mm lens and gets out to 14 feet as claimed, and is virtually immune from "red eye," which is not the case with other add-on or built-in units. Indeed, in examining over 100 portraits shot at various distances on color negative film, we found only a single clearly defined case of "red eye" and even this was not an egregious one.

According to Nikon, a fresh set of alkaline AAs will run approximately 50 36-exposure rolls through the N4004 with no flash and 20 rolls with 50 percent flash usage at normal temperatures. This capacity drops precipitously at below-freezing temperatures and Nikon recommends that you use nicads and carry spare batteries in a warm place when shooting in such environments.

Probably the most impressive feature of the 4004's small, light, super-convenient built-in flash is the way it works to provide balanced fill flash outdoors and pleasant outdoor portraits under backlit conditions. Granted, a modest-powered unit of this size cannot solve all outdoor lighting problems, but as long as your main subject is within the flash's effective range, the camera's TTL circuitry is very adept at matching the flash (main subject) and ambient light (background or foreground)



components of the exposure to deliver pleasant, well-lit pictures. In fact, this is one area in which the 4004 outperforms every sophisticated leaf shutter, point-and-shoot 35 we've tried, and most competitive AF SLRs on the market.

On the front of the camera, about an inch below the overhanging shutter dial, is an unmarked button that's the AE lock. Select an autoexposure mode and push it in while lightly pressing the shutter release and two things happen—the camera switches from automatic triple-sensor metering to a center-weighted pattern and the exposure reading remains locked in as long as you maintain pressure on both buttons. In the Nikon tradition, 60 percent of the meter's sensitivity is now concentrated in the central 12mm-diameter circle of the focusing screen, as indicated by a large fine-lined circle around the focusing brackets.

For a moderately priced camera aimed primarily at first-time AF SLR buyers and many who have never owned an SLR before, the Nikon N4004 is an amazingly competent and comprehensive machine. It may not have continuous framing and focusing modes, but it does have auto wind, power rewind and a very effective AF system. Novices will appreciate that it locks its shutter to prevent you from making virtually any of the standard mistakes, and more advanced photographers will be attracted to its effective, easily understood system of exposure modes and metering options. Everybody, including advanced photographers and pros, is sure to love the way the built-in flash performs and those who opt for one of the accessory flash units (such as the SB-22 we tried) will be even more impressed.

Some of the folks at Nikon privately refer to the 4004 as "a point-and-shoot 35 with interchangeable lenses." It is, but as we've seen, it is also much more than that. No, the Nikon N4004 is not built like a Nikon F3 and it's not the right AF Nikon for those who often use non-AF lenses, but it is, in these times, a remarkably good value for the money and an excellent all-around picture-taking machine. If any camera currently on the market can help turn neophytes into serious amateurs, this is surely it. And any serious photographer clever enough to choose it as a "thinking person's point-and-shoot 35" certainly won't be disappointed.

## 50mm f/1.4 Nikkor Autofocus

**Specifications:** 50mm f/1.4 AF Nikkor, no. 2005750 in Nikon autofocus AI-S bayonet mount; accepts 52mm accessories; f/1.4 to f/16 with full stop detents; minimum aperture lock, min. foc. dist.: 18 in. (0.45m); 1 5/8 in. long, 2 9/16 in. diam. (42x65mm); 9 oz. (255g). \$267.50.

**Practical comments:** Smooth auto- and manual focusing but with relatively narrow manual focusing ring. Highly legible scales in white on satin black. Inset distance scale with dual (f/11, f/16) depth-of-field scale.

**Field test slides:** Images overall were crisp and snappy. Wide open, there was

some slight softness in the corners, which was gone by f/2.8. Center to corner sharpness was very good from f/4 onwards. Very minimal barrel distortion was noted. Flare well-controlled, but under extreme conditions wide open, flare could affect contrast.

**Optical bench analysis:** On axis, very slight overcorrected spherical aberration, which was gone by f/11. Off axis, there was very slight skew ray flare and very slight astigmatism, both almost gone by f/11. Lateral color was observed throughout.

## NIKON N2020AF: AN AUTOFOCUS SLR OFFERING LENS COMPATIBILITY

**MANUFACTURER'S SPECIFICATIONS:** Nikon N2020AF autofocus 35mm single-lens reflex camera. Body No. 5103365. **LENS:** 50mm f/1.8 AF Nikkor in Nikon AF AI-S bayonet lens mount. **SHUTTER:** Electronically controlled vertical travel metal blade with speeds from 1 to 1/2000 sec. plus B. **EXPOSURE SYSTEMS:** Program, High Speed Program, Dual Program and Aperture Priority auto exposure modes or matched diode manual mode use center-weighted readings. **Silicon photo diode cell above eyepiece reads light from focusing screen; second SPD cell in mirror chamber reads light from film for autofocus metering; EV 1-19 at ISO/ASA 100 with f/1.4 lens; auto DX film coding ISO/ASA 25-5000, manual film speed settings 12-3200; exposure compensation  $\pm 2$  stops in 1/3 stop increments. **AUTOFOCUS:** TCL phase detection by Honeywell CCD module in mirror chamber provides single or continuous autofocus capability via integral AF motor, or focus indication in ambient light EV 3-19 at ISO/ASA 100; autofocus lock, manual focus provision. **FLASH:** Four-pin dedicated hot shoe provides programmed or aperture off-the-film flash measurement at 1/125 sec. automatically set flash sync; slower sync speeds available in manual exposure flash mode. **VIEWFINDER:** Fixed eye-level prism with user interchangeable screen. Standard Type B furnished has full focusing matte area, central autofocus area brackets, center-weighted metering area circle; red arrows, green dot LEDs indicate focus; LED transilluminated scale displays shutter speeds, over and under exposure warning signals, incorrect aperture, flash ready and insufficient flash warning signals. **OTHER FEATURES:** Motorized single frame or continuous film advance up to 2.5 fps; auto film loading, auto film advance to frame 1; non-DX coding warning; film reminder window, shutter lock, cancellable 10 sec., electronic self-timer; audible warning signals. **BATTERIES:** Four AAA alkaline, manganese or rechargeable nickel-cadmium cells (or four AA cells in optional Battery Holder MB-3). **PRICE:** \$588.25 with 50mm f/1.8 AF Nikkor. \$479 body only.**

For 27 years Nippon Kogaku has zealously guarded the interests of Nikon owners with Nikon mount lenses. Through three progressive Nikon F body designs plus Nikkor-

## 35MM Single Lens Reflex

exes and many Nikkormats, owners buying new bodies have generally been able, in some manner, to use older lenses on the newer bodies or newer lenses on older camera bodies.

With the incredible success of Minolta's Maxxum autofocus cameras in which a radically new body has been matched to a new, nearly non-compatible lens mount, Nikon owners have been increasingly fearful that future autofocus Nikons would also incorporate a new incompatible lens mount.

They had little reason to fear. With the professionally-oriented Nikon F3 AF of 1983, the designers amply demonstrated Nikon's ability to graft an autofocus system handily onto the traditional Nikon lens mount, even though that camera was limited to two autofocus lenses (80 and 200mm) each of which has an external autofocus motor.

But, could the integrity of the Nikon F lens mount still be protected in a popular amateur autofocusing Nikon SLR needing a complete lens series without sacrificing compatibility? Was it time to retire the famous F bayonet lens mount, forcing Nikon owners to switch or abandon the Nikon system altogether?

Nikon's decision was to continue the F mount with some additional electrical contacts, much like those in the Nikon F3 AF. Nikon reasoned that this would not only allow owners of older, non-autofocusing Nikon or Nikkor lenses to use these optics, but would also provide the additional valuable feature of "focus assist" whereby the autofocus system's green "in focus" light would go on when the older lens was properly focused.

Additionally, Nikon optical engineers set to work producing a device to allow non-autofocusing lenses to autofocus! Based on experience gained from the F3 AF's TC-16AF autofocusing, motorized 1.6X teleconverter which allowed non-autofocus lenses to autofocus on that camera, the optical engineers constructed a similar device for the new autofocus system. The resulting 1.6X TC-16A operates in a similar manner for the N2020 but is far smaller and lighter since no internal motor is needed. The motor is in the camera body proper.

Rather than create a radically new camera body for the autofocusing system as did Minolta, Nikon again took the diametrically opposing tack: the autofocus system would be incorporated into an already tried and well known body, that of the Nikon N2000. (Indeed, repairmen had already noticed in the N2000 that various spaces had been reserved for what they thought might very well be a future autofocus system. However, you cannot have an N2000 upgraded to an N2020.)

As we reported when the N2020 was first introduced: "All major N2000 features are retained: autoloading, autowind, high speed and regular programs, aperture-preferred and manual metering, shutter speeds 1 to 1/2000 sec. visible on a rear LED-lit viewfinder scale, DX and manual film speed indexing, and TTL flash."

Among the few non-autofocus additions to the N2000 found on the N2020 two are of interest. The 2020's focusing screens are interchangeable. They can be reached from inside the mirror box. Two accessory screens exclusive to the 2020 are available. There's a grid screen identical to the screen normally furnished but with the addition of horizontal and vertical lines and a screen



## What's New At A Glance: Nikon N2020AF

Exposure mode selector dial has new P Dual position which automatically shifts AF, AI-S and E lenses from regular to high speed program at 135mm or longer

Separate auto exposure memory lock button (was combined with self-timer button on 2000)

Body, most non-autofocus controls identical to Nikon N2000

Autofocus lock allows focus to be locked when in continuous (C) autofocus mode

Self-timer button is inset to prevent accidental start

All AF lenses have minimum aperture lock button to be used in program modes

Four contact dedicated hot shoe is same as other recent Nikons but new SB-20 flash unit provides pre-exposure autofocus light

Focus mode selector allows choice of continuous focus, single focus or manual focus with focus assist indication

Autofocus AF lenses can be used on other Nikon cameras; Most other Nikon and Nikkor lenses can operate on 2020 (see text)



with central microprism and full focusing area.

An additional control dial setting "P Dual," has also been added which shifts AI-S, AF and E lenses from regular to high speed program automatically if their focal length is 135mm or greater.

Since, aside from autofocus and P Dual, the N2000 and N2020 are nearly identical and we have thoroughly tested the N2000 in the February issue this year, we will, in this N2020 test, concentrate on the autofocus system.

The N2020 uses a phase detection autofocus system similar in concept to that in the Minolta Maxxum, but actually made in the United States by Honeywell where it is called TCL (through camera lens). TCL was fully described technically in MODERN as long ago as April, 1980, so we don't wish to go into its workings again either.

Basically TCL autofocus is a passive "phase detection" system in which the subject's contrast is analyzed by the TCL module and the lens focused by internal motor until maximum contrast and sharpness are achieved. This is quite different from the active infrared autofocus system you'll find in most "point-and-shoot" 35mm cameras whereby an infrared beam is emitted by the camera, bounces off the subject and its angle of reflectance is measured and set in terms of camera-to-subject distance.

The phase detection system is equally good for lenses of any focal length and at any distance but is limited to lenses of reasonably large aperture in relatively good light. The infrared system only operates over short distances but with lenses of any aperture and in nearly any light.

The TCL Honeywell module is located in the bottom of the mirror chamber. It receives light that has passed through the camera lens and the semi-silvered rapid return mirror and has then been reflected to the module by a secondary hinged mirror behind the main mirror. The module relays autofocus information to a central processing unit (CPU).

Aperture and focal length plus other vital information is fed to a CPU in each autofocus Nikkor lens from whence it is transmitted to the camera's CPU via AF signal contacts on the back of each lens and inside the camera lens mount (see picture, page 50). The CPU in the camera body causes the lens to be driven in the direction of proper focus by a coupled, cammed drive gear between body and rear of lens.

Within the N2020's finder, you'll find a screen having no split-image rangefinder and no fine-focusing collar. Instead, centrally, are four corner brackets indicating the autofocusing area, an outer circle outlining the primary sensitivity area of the camera's center-weighted metering system plus a full, fine focusing outer screen area.

At the bottom of the screen are rear LED-lit autofocusing signals. When the lens is focused, a central green LED lights. On either side of the green LED position are red arrows pointing inwards. Each indicates the direction the lens must turn in auto-focus (AF) mode or be turned manually to reach proper green dot focus. If there is insufficient light or contrast for the autofocus system to operate, a red X will light to the left of the left-hand arrow.

In searching for proper focus, the lens will normally be turned by the internal body motor from infinity towards closest focusing point and then back again. If it is at closest focusing already, it will move towards infinity. Although Nikon calls the system "dual autofocus," the N2020 really has three autofocus modes, selected by a lever at the front of the camera. At the S or single-servo autofocus position, you push the shutter release partway in and the autofocus system focuses and then locks at this distance. Until it does focus accurately on the subject, the shutter remains locked so you can't take an out of focus picture. When the green focus continuation LED lights up, press the shutter release further and the picture is taken.

The S position is good for stationary subjects or, as we'll see, for flash shots. The

Minolta Maxxum 5000 and 7000 operate in this mode.

By turning the front lever to the C position, you select continuous-servo autofocus. Now when you press the shutter release partway in, the lens will continuously focus (that is, follow-focus) following your subject or change in aim. Neither the shutter release nor focus is locked. Obviously, this method is the one to use with all moving subjects. In the C position, the N2020 behaves much like the Maxxum 9000.

Both the S and C positions are for AF Nikkor lenses (or the TC-16A converter and non-autofocus lenses). At this writing, only three AF lenses have been made available: the 50mm f/1.8, 70-210mm f/4 and the 35-70mm f/3.3-4.5, all of which are reviewed and tested this month. Yes, the two AF lenses for the Nikon F3 AF, the 80mm f/2.8 and the 200mm f/3.5 ED-IF will also autofocus on the N2020 (although N2020 AF lenses will not autofocus on the F3 AF). But we see little reason for using these since their focal lengths are duplicated by the AF zoom lenses already available. They are also expensive and bulky because of their built-in motors.

By fall, Nikon promises additional AF lenses: 24mm f/2.8, 50mm f/1.4, 55mm f/2.8 micro focusing continuously to 1:1, 180mm f/2.8, 300mm f/2.8, 600mm f/4 plus three zooms, 28-85mm f/3.5-4.5, 35-105mm f/3.5-4.5 and 35-135mm f/3.5-4.5. Other lenses will follow.

At the M position of the aforementioned lever, the cam gearing of the AF autofocus lenses is released and they or any Nikon mount lens can be focused manually using the focus assist green dot indicator to confirm exact focus. Nikon says that lenses must have maximum apertures of f/4.5 or larger to use focus assist. (This mode is also available on the three Maxxum cameras although the Maxxums don't allow any older Minolta lenses to operate with full automation as the Nikon does with non-AF Nikon mount optics.)



Since the TC-16A autofocus converter is such an integral part of the N2020's autofocus system, we'd better examine it now. It's a five-element converter which, like all such converters, fits in between the prime lens and the camera body. Its 1.6X power increases the focal length and decreases the aperture of the attached lens by that amount. In other words a 200mm f/2.8 lens would become a 320mm f/4.8. All marked apertures would be similarly affected. Nikon advises that you use it for autofocus only when your prime lens has an aperture of f/2.8 or larger.

Here's how it works. First you set the focusing ring of your prime lens to infinity and the selector lever to either the S or C position depending on which type of autofocus you wish. When you press the shutter release partway, the converter itself autofocus by moving its lens elements towards or away from the main lens.

So much for descriptions. How does the N2020 AF work in practical field tests?

Using our three available AF autofocus lenses, we found that the camera could focus with commendable accuracy on any logical subject in adequate light. By "logical" we mean subjects that the average photographer—pro or amateur—would normally wish to photograph. Subjects with low contrast differentials, such as a nearly blank wall, or subjects with continuous fine pattern, such as a brick wall, resulted in a red X, "no focus" finder indication. Likewise, a green plant close focused in poor light or heavy shade against similar green plants resulted in an X. Low contrast subjects were particularly difficult close up in macro with the 70-210mm lens with its f/4 aperture.

Repeated horizontal lines such as venetian blinds proved unfocusable with the N2020 in horizontal position. However, turning the camera to a vertical position made venetian blinds easy targets. Suggestion: avoid horizontal repeating lines or change to a vertical hold—at least for focusing such subjects.

We tried both single and continuous focus modes with still subjects and concluded that Nikon's suggestions to use S for stationary and C for moving subjects was correct. Close focused stationary subjects at C such as flowers tended to make the focus mechanism "hunt," moving back and forth in minute movements. In S mode we merely pointed the camera, and pressed the shutter release fully. The camera focused, locked and the picture was taken at sharpest focus. We should caution S mode users, however, to make their pictures immediately. If you focus first, hold focus and then shoot, a natural shooting technique, the subject or you may weave back and forth slightly, changing the focus point. The green light will still indicate correct focus even though you now may be slightly out of focus. When in any doubt, take your finger off the shutter release and autofocus again.

We concluded that the C position would provide continuous autofocus of moving subjects with more accuracy than we could muster manually. Only at distances of 10 ft. or closer with very fast moving, erratic subjects such as children did some of MODERN's testers feel that they might achieve sharper results focusing manually.

Should you wish a subject sharp that is not in the central picture area while shooting in the C mode, Nikon has provided a well

| GENERAL PERFORMANCE                         |                                                                                                                                                                                                          |                                                   |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Checkpoints                                 | Our Standard                                                                                                                                                                                             | As Tested                                         |
| <b>FINDER:</b>                              |                                                                                                                                                                                                          |                                                   |
| Apparent viewing distance                   | Between infinity and 20 in. (0.5m)                                                                                                                                                                       | 52 in. (1.3m)                                     |
| Apparent distance of shutter-speed scale    | Between 49 in. (1.2m) and 22 in. (0.6m)                                                                                                                                                                  | 41 in. (1.1m)                                     |
| Apparent distance of LED focusing indicator | Same as above                                                                                                                                                                                            | 41 in. (1.1m)                                     |
| View area compared to film area             | Vertically and horizontally more than 90%, less than 100%                                                                                                                                                | Vertical: 92%<br>Horizontal: 92%                  |
| Parallax error compared to film             | Vertical: 1.0mm<br>Horizontal: 1.4mm                                                                                                                                                                     | Vertical: 0.1mm (up)<br>Horizontal: 0.05mm (left) |
| Focusing accuracy at maximum aperture       | Within depth of focus                                                                                                                                                                                    | No Discrepancy                                    |
| Image magnification                         | 0.85X ± .1X                                                                                                                                                                                              | 0.85X                                             |
| <b>PICTURE SIZE:</b>                        | 24 ± 0.6mm × 36 ± 0.9mm                                                                                                                                                                                  | 24.2mm × 36.1mm                                   |
| <b>SHUTTER:</b>                             |                                                                                                                                                                                                          |                                                   |
| Curtain travel evenness                     | ± 0.33 stop                                                                                                                                                                                              | 0.005 stop                                        |
| Insulation from sync                        | More than 7 megohms                                                                                                                                                                                      | Infinity                                          |
| Sync contact efficiency                     | More than 60%                                                                                                                                                                                            | 90% (Hot shoe)                                    |
| Sync delay time                             | X: within full opening                                                                                                                                                                                   | Okay                                              |
| Shutter curtain bounce                      | Not allowed                                                                                                                                                                                              | None                                              |
| Self-timer delay                            | 7-15 sec.                                                                                                                                                                                                | 10 sec.                                           |
| <b>CAMERA NOISE:</b>                        | 65dB(a), very quiet for motorized auto-focus.                                                                                                                                                            |                                                   |
| <b>CAMERA SIZE:</b>                         | Body: 5 <sup>13</sup> / <sub>16</sub> in. wide, 3 <sup>13</sup> / <sub>16</sub> in. high, × 1 <sup>13</sup> / <sub>16</sub> in. deep (148 × 97 × 47mm)<br>Lens: 1½ in. long, 2½ in. diameter (39 × 65mm) |                                                   |
| <b>WEIGHT:</b>                              | Body: 1 lb. 6 <sup>13</sup> / <sub>16</sub> oz. (647g) with batteries<br>Lens: 7 <sup>5</sup> / <sub>16</sub> oz. (209g)                                                                                 |                                                   |

placed, black, focus hold button on the front of the camera. Press the shutter release and focus. While holding the release, push the focus hold button and swing the camera to frame your new composition. Press the shutter release fully and the picture will be taken without refocusing. Yes, it will require some practice to hold the release and press the button, but it can be done handily.

We were pleased at how swiftly (faster than a second) accurate focus was achieved in average daylight even in the closest focusing macro positions with the 35-70 and 70-210mm lenses. Longer subject distances seldom proved any problem at all. We felt that the system could indeed autofocus faster than we could manually. Of course, the brighter the light, the more contrasty the subject, or the larger the maximum lens aperture, the easier focus was achieved.

As light and contrast dimmed, autofocus sometimes hesitated before locking in. Usually, the autofocus motor moved the focus swiftly to a point near the proper focus, then slowed slightly as it reached precise focus—all within a split second. The motor seemed to give a satisfying "kerchunk" as it operated. In low light, particularly with the zoom, the focus would bounce from one red

arrow to the other as it sought the exact green dot correct focus. However, the N2020 had no trouble focusing on a none-too-contrasty stone wall with an equivalent illumination requiring an exposure of f/1.8 at 1 sec. with ISO/ASA 100 film.

The 70-210mm f/4 lens was baffled by the same subject and lighting and required a subject exposable at f/4 and 1 sec. before responding with alacrity. (Bear in mind that both these exposures are well below the lowest limitation of hand held exposures and at levels that would sorely try your manual focusing ability.)

We field tested the TC-16A converter with a vast array of Nikon and non-Nikon lenses, both zooms and single focal lengths. With large aperture lenses such as a regular 50mm f/1.4 or f/1.8 AI-S mount Nikkor, the adaptor focused with the same alacrity as did the AF lenses. With f/2.8 maximum aperture lenses such as a 135mm f/2.8, autofocus was quite satisfactory. We tried using smaller aperture lenses than recommended by Nikon and found that the system worked nicely even with a maximum f/3.5 aperture, meaning that zoom lenses having a constant f/3.5 maximum aperture can be used with the converter. When we tried f/4 or zoom lenses which had f/2.8 apertures at wide an-



## 35MM Single Lens Reflex

gle but became f/4 at maximum zoom, we ran into trouble. Autofocus was not certain to work with f/4 maximum lens apertures.

Does the converter work with wide-angle lenses? Beautifully. A lens as wide as a 20mm f/2.8 focused swiftly and accurately.

The converter does have four liabilities. First, there's the problem of possible resolution loss. We tested the converter on the 50mm f/1.8 AF Nikkor and you'll find from our results that central sharpness held up well but there was some loss in corner sharpness—a typical performance even with a good converter. The possible loss in sharpness depends on the lens you fit to the converter. Some combinations work better than others. Most should be more than acceptable although we think that the AF lenses alone will prove to have better resolution.

Secondly, as with all converters, there is a loss in finder brightness. With the TC-16A this loss is slightly greater than a full f/stop.

Thirdly, as with all converters, the focal length and aperture do change. While having a tele zoom that is some 1.6X longer may be admirable, an increase of 1.6X in a wide-angle lens may prevent you from achieving the picture you want. For instance, the ultra-wide 20mm f/2.8 lens we used became a semi-wide 32mm f/4—quite a difference!

Lastly, the converter often severely limits the focusing range of the lens to which it is attached, since focusing depends on the amount of back-and-forth movement of the converter lens elements. The longer the focal length of the prime lens, the greater the minimum focusing distance with the converter.

With teles, the minimum distance is often too long for the lens to be used as you might wish. For instance, note that the 100mm lens only focuses to 14 1/2 ft. Even if you consider that the 1.6X converter will make the combination into a 160mm lens, 14 1/2 ft. isn't close enough for a good close portrait. There is a solution to the problem although not a completely satisfactory one. Instead of setting your prime lens to infinity when using the converter, set the focusing ring at a closer distance, preferably near the actual distance to your subject. Then, when you autofocus, the system will probably provide autofocus correctly even if your "guess" is somewhat off.

While this method provides closer autofocus capability, the autofocus range is now far more limited and the lens will not autofocus at long distances until you set the lens focusing ring back to infinity. If the close focusing distances in the table are usually adequate for your needs and you have many Nikon mount lenses, we feel the converter is undeniably a valuable accessory. However, if you think that you will often need closer focusing abilities, we would recommend you either buy the AF lenses or use your present Nikon mount lenses, and focus manually aided by "focus assist."

We liked focus assist. Over the years, we at MODERN have gathered a motley selection of lenses, Nikon-made and others. We busily set to using them. We found that we could easily focus any lens with an aperture of f/4.5 or larger. Turn the focusing ring until the green dot appears and that's that. Telephoto lenses and long zooms, always difficult to focus accurately, snapped right into the green dot although the longer lenses required a bit more sensitive adjustment of

their focusing rings.

Using the macro focusing lenses with focus assist was equally rewarding. Tiny subjects, even at 1:1 or greater magnification, focused easily with a green dot assist. However, at high magnification where the true aperture slipped below f/4.5, don't use focus assist.

We actually found that the focus assist dot seemed to be useable with lenses having f/5.6 or even f/8 apertures. But Nikon warns that in such cases a green "correct focus" dot may indeed appear in error.

Owners of non-Nikon made lenses with Nikon mounts may find that their lens focusing rings turn in the opposite direction than do the Nikon-made lenses. In this case, the red arrow suggestions as to which direction to turn your lens to achieve accurate focus may be reversed. However, once you mentally note the change, you should have no trouble.

Before we leave lenses we must warn you that although most Nikon F lenses will fit and work on the 2020, some won't. Basically AI-S, AI and series E lenses will fit and operate. AI-modified lenses will also fit and operate except the 55mm f/1.2 Nikkor, 28mm f/3.5 Nikkor and 35mm f/1.4 Nikkor with certain serial numbers. Contact your photo dealer, Nikon or us for the serial numbers if you own such lenses.

Non-AI or non AI-S Nikon mount lenses manufactured by other lens makers can usually be adapted to the equivalent of an AI mount by qualified repairmen. However, don't use such lenses unless you have had them checked out.

We do have a suggestion for improving either autofocus or focus assist. An audible (but turn-offable) focus O.K. beep would be quite useful and make it unnecessary to shift your eye from the viewing screen to watch for the green dot.

With the autofocus motor drawing juice from the same batteries as the autowind, electronically controlled shutter and metering mechanism, just how long will a set of AAA cells or AA cells in the optional MB-3 battery holder last? In our N2000 test we reported that fresh AAA cells should last upwards of 90 rolls of 24 exposures. With focus assist, Nikon says you should be able to get 60 36-exposure rolls through (about the same as in the 2000). With AA's in the MB-3 the number jumps to 180. In cold temperatures below freezing, the number is significantly lower. With autofocus, the number of rolls depends very much on how you use the autofocus. In the C mode, you use up far more battery power than in the S mode. The longer and more often you focus, the fewer rolls can be run through the camera on a single set of batteries. Simply put, the number of rolls possible from one set of batteries is quite variable. However, if you do expect to shoot in the C mode often, we'd strongly suggest you purchase the MB-3 AA cell battery holder. As a general rule however, with S autofocus mostly in use, we expect you'll get about half to two thirds the number of shots as in focus assist. In the C mode, we'd think 1/3 to 1/2 the focus assist number could be achieved.

Autofocus does have another effect. It can slow down the 2.5 frames per second autowind. Depending on whether you are using the C or S autofocus mode or focus lock, speed may be reduced to as low as 1.4 fps.

Let's turn now to autofocus with flash. Many flash pictures are made in very low light where the passive phase detection TCL autofocus can't work. When Minolta introduced the Maxxum 7000, they solved this problem by providing flash units which project a pre-exposure near infrared focusing beam. This beam lights the subject with an easily focusable pattern. The autofocus system focuses accurately on the pattern and then the flash goes off. Presto! Autofocused flash pictures.

Nikon uses much the same system although in typical Nikon fashion, the flash unit dedication employing four contacts in the hot shoe is the same as on other recent Nikon cameras. The new four-AA-celled Nikon Speedlight SB-20 has a built-in autofocus illuminator behind a dark red front window. When you push the 2020's shutter release slightly in the S mode, a single vertical line is projected onto the subject, but only when there isn't enough light for the autofocus to work by itself. Almost instantly the 2020 autofocuses on the line. Press further and the flash picture is taken.

We discovered in earlier tests that the SB-20 can project a beam as far as 30 ft. from camera position which means you can have accurately focused flash shots at distances to 30 ft. The SB-20 can cover lenses from 28mm upwards thanks to the built-in rotating lens system. It can bounce light up to 90 degrees or angle its beam down 7 degrees for close-ups, but only for horizontal pictures. It has no provision for vertical bounce. (We hope Nikon introduces some more sophisticated flash units in the future for the N2020

## PERFORMANCE

| Our Standard                                                                      | as Tested       |
|-----------------------------------------------------------------------------------|-----------------|
| <b>Focal length: ±5%</b><br>(47.50- 52.50mm)                                      | 51.85mm         |
| <b>Aperture: ±5%</b><br>(f/1.71-1.89)                                             | f/1.82          |
| <b>Distortion:</b><br>(±1.5%)                                                     | 0.96% (pinchsn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.5 stops       |

## RESOLUTION

| NIKKOR AF 50mm f/1.8<br>at 50mm/1:50 |                      |    |                      |    |
|--------------------------------------|----------------------|----|----------------------|----|
| f/                                   | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 1.8                                  | Good                 | 59 | Excellent            | 45 |
| 2.8                                  | Good                 | 56 | Excellent            | 50 |
| 4                                    | Good                 | 56 | V. Good              | 50 |
| 5.6                                  | V. Good              | 63 | Excellent            | 56 |
| 8                                    | Excellent            | 70 | Excellent            | 63 |
| 11                                   | Excellent            | 70 | Excellent            | 63 |
| 16                                   | Excellent            | 63 | Excellent            | 56 |
| 22                                   | V. Good              | 56 | Excellent            | 50 |

## CONTRAST

| NIKKOR AF 50mm f/1.8<br>at 50mm<br>at 30 lines/mm |            |    |            |    |
|---------------------------------------------------|------------|----|------------|----|
| f/                                                | Center (%) |    | Corner (%) |    |
| 1.8                                               | High       | 52 | High       | 36 |
| 2.8                                               | High       | 61 | High       | 46 |
| 4                                                 | High       | 70 | High       | 57 |
| 5.6                                               | High       | 74 | High       | 67 |
| 8                                                 | High       | 75 | High       | 67 |
| 11                                                | High       | 73 | High       | 59 |
| 16                                                | High       | 65 | High       | 56 |
| 22                                                | Medium     | 47 | High       | 42 |



with just such features.) However, the SB-20 does have a standby position where it remains off but automatically switches on when you press the shutter release slightly. It can operate in TTL flash mode for existing-light-plus-flash shots, direct autofocus with its own sensor and manual flash in full power and fractional power down to 1/16th. The manual guide number in feet is 49 for ISO/ASA 25 film with a recycling time of 6 sec. using alkaline energizers. However, the unit has energy saving circuitry so far more flashes and faster recycling can be realized with fairly close subjects. Using ISO/ASA 100 film the shooting range in the N (normal angle) position is from 6 to 49 ft. An auxiliary over-the-shoulder external power supply, the SD-7, holds six C-cells but was not available at test time.

You can couple the SB-20 with other TTL Nikon flash units for multiple TTL-controlled flash shots. The SB-20 can be used on other Nikon SLRs and other Nikon TTL flash units will work on the 2020 but without autofocus illumination.

For any Nikon enthusiast, the N2020 (called the 501 in Japan and elsewhere by the way) would seem the way to go for autofocus. And autofocus, we think, is the way nearly all SLRs will eventually go since autofocus is far faster and more accurate than handling most subjects manually. Compatibility with Nikon mount lenses is all that Nikon could make it. Additionally, you have the benefit of both single and continuous autofocus—all in one camera which, as the N2000, was a big hit without autofocus at all. (August 1986)

## NIKKOR 50mm f/1.8 AUTOFOCUS

**Specifications:** 50mm f/1.8 AF Nikkor, No. 2001659 in Nikon autofocus AI-S bayonet mount, accepts 52mm accessories; f/1.8 to f/22 with full stop detents beginning at f/2; minimum aperture lock, min. foc. dist.: 18 in. (0.45m); 1 1/2 in. long, 2 1/2 in. diam. (38 x 64mm); 7 3/8 oz. (210g). \$109.25.

**Practical comments:** Auto and smooth manual focusing via ribbed front ring, fine satin-black finish, finely legible markings with inset distance scale window.

**Field test slides:** 50mm AF Nikkor transparencies were crisp and snappy with well rendered detail. Sharpness improved with corners equalling center by f/4. Slight pin-cushion distortion was noticed. Flare was well controlled throughout. Overall an average to above average normal lens.

**Optical bench analysis** (for optical experts): On axis, slight over-corrected spherical aberration and very slight axial color that was almost all gone by f/8. The lens was diffraction limited by f/11. Off axis, there was very slight coma, very slight astigmatism and almost no lateral color. (August 1986)

## OLYMPUS OM-2S PROGRAM: SUCCESSOR TO THE OM-2N

**MANUFACTURER'S SPECIFICATIONS:**  
Olympus OM-2S 35mm single-lens reflex,  
Body No. 1017674. LENS: 50mm f/1.8

**Zuiko Auto-S in interchangeable bayonet mount, No. 5022395, focus to 18 in., accepts 49mm threaded accessories. SHUTTER: Electronically-controlled cloth focal-plane with speeds from 240 secs. to 1/1000th sec., mechanical speeds 1/60th sec. and B, X-sync. to 1/60th sec., electronic self-timer. VIEWING: Non-interchangeable eye-level prism with central split image rangefinder, micropism collar, full area, interchangeable focusing screens. METERING: Two 1.5 volt silver-oxide batteries power silicon cell in mirror chamber measuring center-weighted area or 2% spot centered in total picture area from light transmitted through mirror and reflected off a Fresnel condensing secondary mirror, from the first shutter curtain, or directly from the film surface during longer exposures; ASA 12 to 3200, TTL auto-flash, aperture-preferred or programmed auto-exposure or metered manual spot exposures. VIEWING: LCD linear shutter-speed scale at left side of finder shows center-weighted auto exposure for both aperture-preferred or programmed auto exposure, LCD indicators for match/LCD manual spot metering, over- and under-exposure warnings, Program on/off indicator, Flash ready, sufficient light or under-exposure signals, blinking exposure override warnings. OTHER FEATURES: Battery check beeper and LED set with exposure mode selector. Weather-resistant body construction, film box end holder, accepts Data Back, finger grip, auto winder or motor, bulk film back. PRICE: \$380 body only; \$480 with 50mm f/1.8 Zuiko lens; \$550 with 50mm f/1.4 Zuiko, \$750 with 50mm f/1.2 Zuiko.**

When Olympus introduced its revolutionary OTF metering OM-2 SLR back in 1976 it created a sensation and set the trend for future SLRs. The ensuing years have seen refinements and minor design changes in this uncannily accurate, compact system SLR. Now, with the OM-2S, the mold has been broken. Although many of the new OM-2S's features premiered in the original OM-2, the OM-4—designer Maitani's latest revolution—is clearly the father of the OM-2S Program. The OM-2S will replace the OM-2N in the Olympus line.

The new camera is built into the OM-4's rugged, humidity-resistant body and adds a justly-apportioned mix of OM-4 features to the basic OM-2N ingredients. Starting with the basic aperture-preferred, center-weighted OTF continuous light and flash exposure system, the 2S contributes a simplifying hands-off programmed auto-exposure system for quick-shooting and, in manual mode only, a variant of the OM-4's spot metering system for more precise workers. A large LCD shutter speed and function indicator panel running vertically along the left side of the finder screen keeps your technical data handy yet out of the viewfinder area. A 10 sec. push-button-operated switch illuminates the scales evenly for easier reading in dark locations. The light stays on for 10 sec. to conserve power.

The new body is substantially similar to that of the OM-4 (reviewed in our May 1984 issue, page 78); dimensions and weight are nearly identical. The extras have not added appreciably to the weight of the OM-2N. The dedicated flash shoe is now permanently attached to the flatter profile of the redesigned prism housing, while a separate 5-

## 35MM Single Lens Reflex

contact body socket takes the remote cords used for Olympus's versatile flash system. Mechanically and electrically this is a major step forward from the early system of interchangeable shoes and flash sockets. Both features, of course, were introduced on the OM-4.

Minor changes to the exposure mode selector lever permit selection of Program, Auto (aperture-preferred), or Manual/Spot, or an audio-visual battery check. (It both beeps and blinks). Also picked up from the OM-4 are the blinking and beeping electronic self-timer which, best of all, locks the mirror up at the beginning of its count-down to exposure—a boon for those wishing to shoot shake-free pictures at high magnifications. The beeper also signals certain camera mis-settings such as forgetting to set the lens to its smallest stop in Program mode or warns of potential over-exposure if your preferred aperture is too large in normal auto-exposure mode. Turning the ring around the bezel of the signalling LED on the camera front turns off the beeper when desired.

Manual shutter speeds are 1/60th sec. and B; both are still usable if your battery should die of neglect or overuse. The twin, easily-lost, battery and motor clutch covers are still present but now they both thread on more securely instead of relying on delicate bayonet catches. Unfortunately, the threaded motor cover can no longer be parked inside the winders where a recess was provided for the thinner bayonet alternative. Perhaps some judicious file work could enlarge the space. One solution is to buy the new, high speed Motor Drive 2, which has a threaded recess for the hatch cover on the camera side of its hand grip. The 2S' rewind release like the OM-4's is now an easily-accessible pushbutton right behind the shutter release where it is more convenient to turn than the older front-mounted turn-to-rewind knob. Still hard to grip are the small tabs on the manual shutter-speed ring which require more frequent use if you're into the match-LED spot-metering manual exposure system. With a large lens mounted on a motor-driven camera, access becomes a challenge for occidental fingers—a standard gripe of OM owners. Fortunately, with an OM it is rarely necessary to go off automatic.

Let's power up the system and take the OM-2S for a ride. Two MS-76 alkaline or silver batteries drop into the clearly marked battery recess in the camera bottom. Screw on the battery cover and you're in business. Pulling up on the rewind lever pops the removable back open for film loading, a straight forward and conventional operation. The slotted take-up spool reverse winds the film for claimed maximum film flatness. Snap the back shut, and wind and fire away 'til frame 1. If you're in either automatic mode and load with the lens cap on, the shutter can remain open for up to 2 minutes—which will slow down the loading process appreciably. Set the camera to manual to expedite things or load the camera with the cap off in a relatively light area. This is true of most aperture-preferred automatic cameras and is not a weakness of the OM system.

Turning to the top of the camera, we find the traditional Olympus OM-2 film-speed setting and exposure-compensation dials just to the left of the film advance lever. ASA speeds from 12 to 3200 are set by lifting and turning the dial appropriately. Line up the index on the knob with that of the prism housing to set



## What's New At A Glance: Olympus OM-2S



the correct exposure bias. The exposure mode selector is mounted concentrically around the rewind knob. Pushing the lever to the front of the camera tests the battery power. A steady tone and glow from the LED indicates all's well. Intermittent flashing or tone pulses warn of weak batteries.

Let's start off in Program mode which provides an easy and almost fool-proof picture taking process. In this mode, the OM-2S simultaneously changes shutter speed and apertures to provide the best combination for most purposes. Shutter speeds are visible in finder; as in other OM's, apertures are not shown. Note that the lens remains at maximum aperture until there's enough light to exceed 1/60th sec. and then begins to close down in concert with the increasing shutter speed until the maximum shutter speed, 1/2000th sec. is reached. At that point, the lens stops down alone. This is a general purpose exposure program suitable for most situations and focal lengths. If you want something more specific, it's as close as your mode selector. In the finder, along the left side, a 1/3-stop calibrated shutter-speed scale, similar to that of the OM-4, shows the speed set by the exposure system whether you're in Program or Auto (aperture-preferred) mode. How do you tell which mode you're in? PRGM, for program, is spelled out on the top of the data column. Just below it an image of a lens diaphragm will blink if you've forgotten to stop down your lens enough to avoid over-exposure. Just below this symbol, the word "over" will appear to warn of over-exposure in Auto mode. If you have an exposure override set, +/- symbols at the bottom of the screen will flash a reminder. A green LED signals flash ready, confirm flash exposure or warn of flash over- or under-exposure. Using an Olympus-dedicated flash in Program mode with the lens set at its minimum aperture produces full fill-in flash at full aperture if the light level is below 1/8th sec. If there is more available light, the lens automatically stops down 3 stops to minimize chances of ghosting. In both cases, the shutter is set to 1/60th sec.

How does a basically aperture-preferred exposure system function in Programmed mode? It is a two-step exposure process. Setting the lens to its minimum aperture starts the process. The photocell in the cam-

era bottom takes a center-weighted reading of light transmitted through the semi-transparent mirror and reflected off a secondary Fresnel condensing reflector located on the back of the main mirror. This pre-selects the shutter speed and camera aperture. Now the mirror and secondary mirror flip up, the exposure starts and the same cell reads the actual light reflected off the first shutter curtain or film surface, fine-tuning the exposure for even greater accuracy and compensating for changes in the scene lighting during the exposure. In other words, the exposure system does a two-step in real time to provide increased exposure accuracy.

Not much needs to be said about the normal Auto setting. It's Olympus' time-proven OTF center-weighted aperture-preferred exposure system, reading off the film (or shutter curtain) during the actual exposure, adjusting shutter speed where necessary or controlling the duration of an Olympus or other compatible dedicated flash to provide the system's usual high exposure accuracy. The OM-2S' system provides similar accuracy, threshold sensitivity to near-moonlight levels, and immunity to eyepiece-transmitted stray light. The shutter-speed range is continuous from faster than 1/1000th sec. to 2 min. or more. The major difference between the OM-2 and 4 here is the latter's marked 1/2000th sec. top speed. While most OM-2 shutters can reach 1/2000 sec. in automatic operation, this is considered an uncalibrated speed for emergency use only. It's true, of course, that the OM-4's exposure lock works in normal center-weighted automatic use as well, but its strongest point is that it works the camera's spot-metering automatic mode.

The major mode for use of Olympus' OTF system flash is aperture-preferred Auto. With full control of the lens' diaphragm, maximum control of flash range and depth of field is easily achieved. Any aperture permitted by flash power can be pre-selected and the flash metered out in just the right amount. Only in Auto mode can the small apertures necessary to get sufficient depth of field for close-up work and the large apertures needed to bridge long distances be pre-set. Flash in the Program mode is more limited and is primarily designed for "people" photography and rapid candid shots.

The OM-2's Spot/Manual mode is its sec-

ond major departure from the OM-2N. Here the camera's secondary Fresnel mirror transmits light directly to the photocell in the body cavity which now reads only the central 2% of the finder area—an area delineated by the central micropism spot on most Olympus focusing screens. In this mode, the OTF exposure system is bypassed, exposure is not read in the film plane or corrected for real-time light level changes at the subject, and the OTF automatic flash exposure control is inoperative. Setting the mode selector to Spot/Manual shifts control of the shutter over to the concentric control ring around the lens mount, bypassing the automatic shutter-speed control circuits, and bringing a second set of finder LCD readouts into play. They are the electronic analogues of the OM-1 and OM-2's meter needle and index system and the similar LCD system of the OM-3 and 4. Center the micropism area over the subject area desired and adjust shutter speed or lens aperture to match the LCD array's top with the index between the arrow heads for normal subjects, just like a meter needle. You can bracket exposures rapidly by moving the line up and down the indicators which are spaced at calibrated exposure intervals as shown in the drawing on page 64. Very accurate exposures and brackets are obtainable after you have become accustomed to the system. Metering the light and dark areas of importance in your subject gives you a precise idea of its brightness range so your exposure can be tailored to suit. While the camera lacks the automatic exposure averaging and highlight and shadow density presets of the OM-4, the OM-2S' relatively inexpensive, direct-reading system will certainly produce equivalent exposure accuracy at some sacrifice of speed and convenience.

The OM-2S is compatible with all lenses, winders, finders, motors and other Olympus and Olympus-compatible accessories. The plastic triggering pin needed to warn the OM-4's metering system when a lens was changed are not needed here so OEM and independent manufacturers' lenses may be interchanged with reckless abandon. The Winder 2 and Motor Drive 2 were fully described in our OM-4 report which is available from our Reader Service Editor, 825 7th Ave., N.Y. NY 10019, almost for the asking. Because of the slight time delays inherent in



the OM 2S' two-stage metering system, the Motor Drive 2 can only reach 3.5 f.p.s. instead of 5.

In summary, the OM-2S might be called the Poor Man's OM-4, offering many of the OM-4's features, adding Programmed auto-exposure and coming in at a list price substantially less than the OM-2S it replaces. At the resulting far lower street price, such a bargain should be almost irresistible to the Olympus user. If any carping criticism might be made it would have to be about the legibility of the finder readouts under poor light. Shooting from dark areas into brighter ones, the LCD readouts become difficult to read without use of the finder illuminator which winks out, frustratingly, after 10 brief seconds. This is certainly time enough to read a shutter speed in an automatic mode but makes it difficult to do a thorough spot-reading of several points on the subject. If the finder switch were part of the shutter release and went on automatically when it was needed through either a secondary photocell or an independent on/off switch, critical use of the splendid LCD panels on the OM-2S, OM-3 and OM-4 would be enhanced. If more battery power is needed to run these little lights, why not bypass the camera batteries with a power take-off from the winder or motor batteries?

A slight pressure on the MODE selection lever can shift you from Program to Auto or vice versa. Your exposure will be correct unless your diaphragm is inappropriately set—in which case the finder's LCD signals will warn you in advance. (July 1985)

## 50mm f/1.8 ZUIKO

### PERFORMANCE

| Our Standard                                                                      | as Tested       |
|-----------------------------------------------------------------------------------|-----------------|
| <b>Focal length:</b> +5%<br>(47.50-52.50mm)                                       | 52.00mm         |
| <b>Aperture:</b> +5%<br>(f/1.71-1.89)                                             | f/1.86          |
| <b>Distortion:</b><br>(+1.5%)                                                     | 0.93% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.8 stops       |

### RESOLUTION

| ZUIKO AUTO-S 50mm f/1.8<br>at 1:49 |                    |    |                    |    |
|------------------------------------|--------------------|----|--------------------|----|
| f/no.                              | Center<br>Lines/mm |    | Corner<br>Lines/mm |    |
| 1.8                                | V. Good            | 55 | Excellent          | 49 |
| 2.8                                | V. Good            | 62 | Excellent          | 49 |
| 4                                  | Good               | 62 | V. Good            | 55 |
| 5.6                                | V. Good            | 69 | Excellent          | 62 |
| 8                                  | V. Good            | 69 | Excellent          | 62 |
| 11                                 | V. Good            | 62 | Excellent          | 55 |
| 16                                 | Good               | 55 | V. Good            | 49 |

### CONTRAST

| ZUIKO AUTO-S 50mm f/1.8<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------------|---------------|----|---------------|----|
| f/no.                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 1.8                                       | High          | 47 | Medium        | 31 |
| 2.8                                       | High          | 54 | High          | 39 |
| 4                                         | Medium        | 56 | Medium        | 42 |
| 5.6                                       | High          | 59 | Medium        | 44 |
| 8                                         | High          | 60 | High          | 46 |
| 11                                        | High          | 53 | High          | 40 |
| 16                                        | Medium        | 42 | Medium        | 36 |

### GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                               | As Tested                                         |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                            |                                                   |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                         | 29 in (0.75m)                                     |
| Apparent distance of shutter-speed scale | Between 157 in (4.0m) and 31 in (0.8m)                                                                                     | 39 in (1.0m)                                      |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                  | Vertical: 96%<br>Horizontal: 94%                  |
| Parallax error compared to film          | Vertical: 0.5mm<br>Horizontal: 1.1mm                                                                                       | Vertical: 0.05mm (up)<br>Horizontal: 0.1mm (left) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                      | No Discrepancy                                    |
| Image magnification                      | 0.86±.1X                                                                                                                   | 0.89X                                             |
| <b>PICTURE SIZE:</b>                     | 24±0.6mm x 36±0.9mm                                                                                                        | 24.2mm x 36.1mm                                   |
| <b>SHUTTER:</b>                          |                                                                                                                            |                                                   |
| Curtain travel evenness                  | ±0.33 stop                                                                                                                 | 0.02 stop                                         |
| Insulation from sync                     | More than 7 megohms                                                                                                        | Infinity                                          |
| Sync contact efficiency                  | More than 60%                                                                                                              | 74% (pc)<br>72% (hot shoe)                        |
| Sync delay time                          | X within full opening                                                                                                      | Okay                                              |
| Shutter curtain bounce                   | Not allowed                                                                                                                | None                                              |
| Self-timer delay                         | 7-15 sec.                                                                                                                  | 12 seconds                                        |
| <b>CAMERA SIZE:</b>                      | Body: 5 1/2 in. wide, 3 5/16 in. high, 1 3/16 in. deep (140x85x30mm)<br>Lens: 1 1/2 in. long, 2 3/8 in. diameter (32x60mm) |                                                   |
| <b>WEIGHT:</b>                           | Body: 1 lb 3 5/16 oz (548g) with batteries<br>Lens: 5 5/8 oz. (160g)                                                       |                                                   |

The standard lens remains the 50mm f/1.8 Zuiko. It features satin black finish, click stops at full stop intervals and a diamond-textured rubber focusing ring. Apertures from f/1.8 to f/16 are selected by a 45 degree turn of the front diaphragm ring. Closest focus is .45M (1 1/2 ft.) obtained with a 160 degree turn of the focusing ring. The depth-of-field scale is calibrated at f/4, 8 and 16; a red focusing index and infrared indicator are provided. Feet are calibrated in gold, meters and apertures in white.

**Field test slides:** Our slides were snappy and crisp with well-rendered details. Wide open the corners were a bit softer than the center, but by f/4 the corners equalled the center. Flare was well-controlled throughout; but some light falloff was noticeable wide open, disappearing as the lens was stopped down. Performance was typical for a normal focal length lens of this speed.

**Optical bench analysis** (for optical experts only): On axis, we saw very slight over-corrected spherical aberration. Very slight red flare, almost gone by f/5.6. Performance was diffraction limited by f/8. Off axis, very slight skew ray flare mixed with very slight coma was visible. Very minimal lateral color was seen.

## OLYMPUS OM-3: MECHANICAL PRO FEATURES AVERAGING AND SPOT METERING

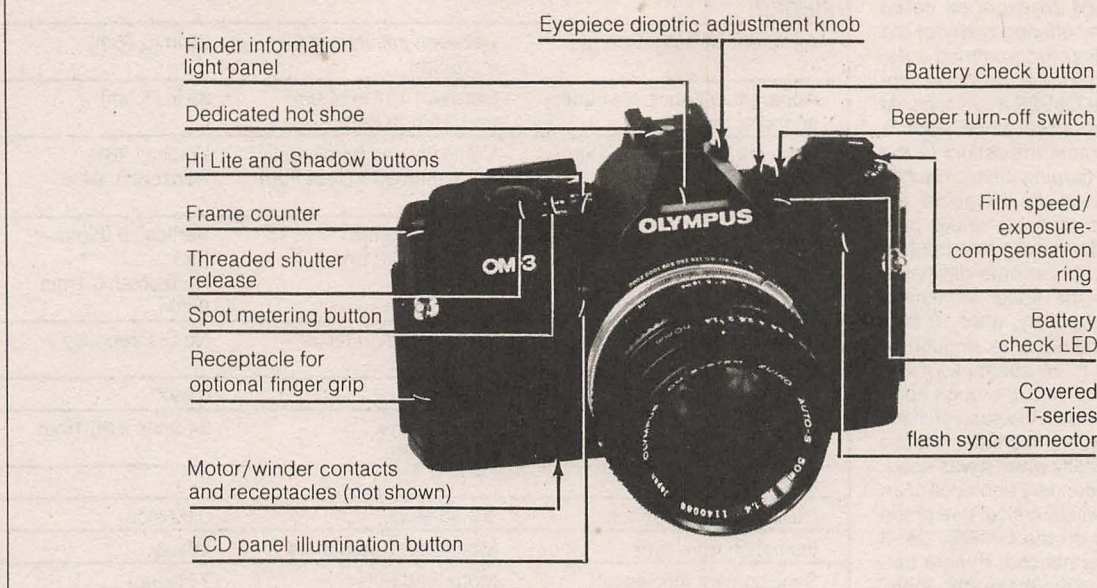
**MANUFACTURER'S SPECIFICATIONS:** Olympus OM-3 35mm single-lens reflex, Body No. 1006852. LENS: 50mm f/1.4 Zuiko Auto-S in interchangeable bayonet

mount, No. 1140088, apertures to f/16, focus to 18 in., accepts 49mm accessories. **SHUTTER:** Mechanically-controlled horizontal cloth focal-plane with speeds from 1-1/2000 sec. plus B, X sync to 1/60 sec. **EXPOSURE SYSTEMS:** Two 1.5 volt silver-oxide batteries power dual concentric silicon cell circuit in mirror chamber measuring center-weighted area or 2% central spot, using light passing through central semi-silvered mirror area and reflected off Fresnel condensing secondary mirror, ASA/ISO 6-3200. **FLASH:** 3-contact dedicated hot shoe provides flash ready and flash OK signals in finder; 5-pin connector for non-TTL autoflash using T-series Olympus flash units. **VIEW-FINDER:** Non-interchangeable eye-level prism with central split-image range-finder, micropism collar, full area interchangeable focusing screen. Linear LCD scale at bottom of finder provides match-needle type manual exposure control, up to 8 spot readings with calculated average exposure, highlight and shadow-favoring exposure shifts, exposure compensation to ± 2 stops with flashing warning, variable (-3 to +1) diopter eyepiece, built-in meter scale illuminator with 10-sec. limiter. **OTHER FEATURES:** Cancellable beeper sounds for battery check, spot highlight and shadow readings, and meter all "clear" control; inclement-weather-resistant body construction, film box end holder, accepts data back, finger grip, auto winder, motors, bulk film back. **PRICE:** \$855.00 with 50mm f/1.4 Zuiko lens; \$1040.00 with 50mm f/1.2 Zuiko, \$770.00 with 50mm f/1.8 Zuiko; \$660.00 body only.

Ask a seasoned professional photographer



## What's New At A Glance: Olympus OM-3



what kind of 35mm SLR he/she wants and the answer will more than likely be, "A simple, rugged, manual, mechanical model that remains fully operational if the batteries go on the fritz." Press the matter a bit further and you'll discover that pros value such features as high speed motor drive compatibility, provision for accepting bulk film and databacks, interchangeable viewing screens and spot metering capability. Very low on the "must have" list are self-timers, auto-exposure modes and the sundry electronic devices found on most of today's "photo enthusiast" SLRs. In short, pros are a hidebound, conservative lot when it comes to selecting equipment; they value reliability and simplicity above all and want (or at least say they want) cameras that are durable, dependable working tools that are free of all superfluous doodads.

If there is any 35mm SLR on the market today that exemplifies the professionals' stated philosophy it's the Olympus OM-3, a match-needle-metering-only SLR that's entirely mechanical except for its center-weighted and multi-spot metering system. It is based on the very well sealed, diecast alloy OM-4 body but compared to that high tech multi-mode marvel, the deletions are many and the additions are few. Missing on the OM-3 are the OM-4's off-the-film-and-shutter-curtain auto-exposure modes including TTL autofocus and auto-exposure memory. And as if to drive home the point that this is indeed "a limited production pro model," even a self-timer has been left off. The main addition is the OM-3's most distinctive and vital feature—its all-mechanical cloth focal-plane shutter that remains fully operational at all settings (1-1/2000 sec. plus B) whether there are batteries in the camera or not. Despite the absence of modes, features, and their concomitant electronics, the OM-3 is pleasantly hefty for a very compact SLR, weighing in at 1/4 oz. less than the OM-4.

Not surprisingly, the OM-3's top controls are arrayed very similarly to those on the OM-4. The Spot, Hi Lite, and Shadow buttons are clustered to the left of the large, round shutter release to the right of the

prism. The "clear" switch to cancel all spot readings is built into the shutter release collar, and the rewind button's conveniently placed atop the body to the left of the wind-lever pivot. The battery check LED has been moved to the left of the pentaprism housing, and the OM-4's long "Auto-Manual-Battery Check" lever has been replaced by a button marked "Battery Check", and a stubby lever in between the button and LED which turns off the OM-3's beeper when you push it toward the front of the camera.

The combined ISO/ASA and exposure-compensation control around the rewind crank shaft is the same mildly-irritating device fitted to the OM-4. To change film speed settings you've got to lift the outer ring against spring tension while turning it and if you can't get the appropriate digits to appear in the tiny window at the back the first time around you must release the ring, turn it back, lift it up and turn it forward (or back) again to get the right setting. Happily, you don't have to do this very often and settings, once made, are unlikely to be changed accidentally.

Emerging from the left-hand side of the OM-3's prism housing, below the 2-contact, dedicated-but-non-TTL hot shoe is another OM-4 feature, the dioptic adjustment knob for the eyepiece. Olympus advises you to adjust for your individual eyesight (-3 to +1 diopters) by removing the lens, bringing the camera to eye level and "pulling out and rotating the adjustment knob until the micro-prism becomes clear"—good advice.

The remainder of the OM-3's controls hover even more closely to the pattern set by the OM-4. On the right-hand side of the lens surround there's a finder illumination button which lights up the white-on-blue LCD exposure readouts in the finder for 10 sec., on the lower left-hand part of the lens surround there's a (covered) PC flash outlet, and on the front of the camera below the rewind crank, there's a 5-prong flash sync contact for T-series Olympus flashes that's covered by a tiny (and losable) screw cap. Although the instruction manual cautions that such flash units must be set to "Normal Auto" for autofocus it capably avoids mentioning the

OM-3's lack of TTL flash automation, a feature pioneered by Olympus and found on all OM-2 and OM-4 models and even on the OM-PC! Speaking of manuals, the official OM-3 *Instructions* is tersely written and indifferently illustrated while its companion, *For your Creative Photography* is better in both respects, but still not up to the quality of the camera itself.

As mentioned, there's no electronic self-timer (or any other kind) on the front of the OM-3. Ordinarily this would not be a serious omission on a professional camera, but it is on the OM-3 since it would have provided the next best alternative to a manual, mechanical mirror lock-up, a "professional" feature that's lacking on the OM-3. The lock-out button for manual mechanical settings of B and 1/60 sec. found on the OM-4 is also missing because it's unnecessary on the OM-3. The bottoms of both models are virtually identical, with similarly placed arrays of 5 motor drive coupling terminals, receptacles, tripod sockets, and covers for the motor drive coupling socket and battery chamber.

Now that we're familiar with the OM-3's layout, let's see how it operates. We'll presume that the eyepiece has been set to our liking and the film speed setting is correct. To load film, pull up smartly on the rewind knob and the back swings open to the right. The interior is beautifully finished, and conventional except for a large gold contact below the sprocket shaft that mates with the accessory Olympus Recordata back. The multi-slotted take-up spool is nicely contoured and makes the OM-3 easier and quicker to load than most SLRs.

Now bring the camera to eye level and lightly press the large, concave shutter-release button. The instant you do so a horizontal, segmented line, fixed metering index with plus and minus signs and your selected shutter speed appear in white LCD characters on the blue-gray panel below the focusing screen. In ordinary lighting conditions these large, legible readouts are illuminated by a narrow frosted panel on the front of the prism housing, directly above the Olympus nameplate. In very low light, press the finder



illumination button once and the panel will light up and stay lit for 10 sec. only to conserve battery power.

As soon as the readouts appear, you're in center-weighted metering mode. To get the correct exposure you line up your subject, turn the aperture ring near the front of the lens (or the traditional Olympus shutter-speed ring placed concentrically around the lens mount) until the left-hand end of the segmented line coincides with the short vertical index line in between left-and right-pointing arrows. If the light level increases or you select slower shutter speeds, the line extends; if the reverse, the line retracts. In other words, the segmented metering line and fixed index function in exactly the same way as an "old fashioned" analog meter needle. Since each of the line's segments corresponds to a  $\frac{1}{3}$ -stop interval, the wide ends of the aforementioned arrows correspond to plus and minus 1 stop respectively, and there are additional dots in both and plus and minus signs to indicate exposure deviations up to  $\pm 3$  stops, the OM-3's exposure readouts are commendably precise and very logical. You can even set precise-exposure values in between whole f/stops with greater-than average accuracy because Olympus lenses generally have detents at whole stop intervals with lots of "metering room" in between them.

Once you've turned the meter on, you're free to select the OM-3's other metering options but you have to do so in the right order. Like the OM-4, the OM-3 offers the possibility of single or averaged multiple spot readings plus highlight or shadow-biased readings, but not all at once. For single spot metering, center the microprism collar over a critical subject area (such as a face) and press the round, raised "Spot" button to the left of the shutter release. The camera will beep (if the beeper's turned on), a diamond corresponding to the memorized spot reading will appear above the segmented metering line, and the metering line will extend only to that point. To set the correct "single spot" exposure turn the aperture and/or shutter-speed ring until the line (and the diamond) coincide with the fixed metering index. The spot reading will not change when you recompose the shot unless you either press the "clear" lever or take the picture.

But suppose you want to take multiple spot readings of different key areas of your subject? Just place the microprism collar over whatever part(s) of the subject that are important exposure-wise and press the Spot button. Each time you do, the beeper will chirp, another "spot reading" diamond (up to 8) will appear above the metering line, and the readings will be stored. To obtain the exposure setting corresponding to an average of all (2 to 8) spot readings turn the aperture and/or shutter-speed dial until the metering line coincides with the fixed index line. If you want to add metering emphasis to any particular subject area, you can press the Spot button twice or even three times while it's centered in the finder—a very useful technique when shooting in tricky lighting situations.

This brings us to the Hi Lite and Shadow controls which, like the Spot modes, work in much the same manner as those on the OM-4—albeit only in "metered manual" mode. To select either Hi Lite or Shadow mode, you've first got to turn the meter on, take a spot reading of a very light or very dark area

| GENERAL PERFORMANCE                      |                                                                                                                                                                               |                                                    |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Checkpoints                              | Our Standard                                                                                                                                                                  | As Tested                                          |
| <b>FINDER:</b>                           |                                                                                                                                                                               |                                                    |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                                            | 39 in. (1.0m)                                      |
| Apparent distance of shutter-speed scale | Between 79 in. (2.0m) and 26 in. (0.66m)                                                                                                                                      | 39 in. (1.0m)                                      |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                                                                     | Vertical: 96%<br>Horizontal: 97%                   |
| Parallax error compared to film          | Vertical: 0.5mm<br>Horizontal: 0.5mm                                                                                                                                          | Vertical: 0.2mm (down)<br>Horizontal: 0.1mm (left) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                                         | No Discrepancy                                     |
| Image magnification                      | 0.84X $\pm$ .1X                                                                                                                                                               | 0.87X                                              |
| <b>PICTURE SIZE:</b>                     | 24 $\pm$ 0.6mm X<br>36 $\pm$ .09mm                                                                                                                                            | 24.2mm x 36.1mm                                    |
| <b>SHUTTER:</b>                          |                                                                                                                                                                               |                                                    |
| Curtain travel evenness                  | $\pm$ 0.33 stop                                                                                                                                                               | 0.02 stop                                          |
| Insulation from sync                     | More than 7 megohms                                                                                                                                                           | Infinity                                           |
| Sync contact efficiency                  | More than 60%                                                                                                                                                                 | 72% (hot shoe)<br>80% (pc)                         |
| Sync delay time                          | X: within full opening                                                                                                                                                        | Okay                                               |
| Shutter curtain bounce                   | Not allowed                                                                                                                                                                   | None                                               |
| <b>CAMERA SIZE:</b>                      | Body: 5 $\frac{7}{16}$ in. wide, 3 $\frac{1}{2}$ in. high, 2 $\frac{1}{8}$ in. deep (140x83x55mm)<br>Lens: 1 $\frac{9}{16}$ in. long, 2 $\frac{5}{16}$ in. diameter (40x60mm) |                                                    |
| <b>WEIGHT:</b>                           | Body: 1 lb 3 $\frac{3}{8}$ oz (543g) with batteries<br>Lens: 7 $\frac{1}{16}$ oz (218g)                                                                                       |                                                    |

of your subject, and press the appropriate small square Hi Lite or Shadow button to the left of the Spot button. When you do so, you'll get a beep, and the words HI LITE or SHADOW will appear under the word SPOT on the right side of the finder LCD panel. Now align the metering line with the index and take the picture. Depending upon which button you've pressed, the highlight areas in your shot will appear bright white or the shadow areas will appear dark black instead of the "18% neutral gray" provided by an "average non-biased" reflected light meter reading.

The creative control provided by this system is extraordinary providing you're knowledgeable in selecting the highlight and shadow areas, and your subjects with care. And although this system is calculated to provide results with films of "average exposure latitude," we've found that it works very well with all the films we tried—including Kodachrome 64, Kodacolor 200 and Kodak Tri-X.

Without doubt, one of the OM-3's strong points is handling. Few of today's SLR's feel as well balanced and solid, or fit your hands as well and none has a smoother, more predictable or more comfortable shutter release. Indeed this large, slightly convex shutter button (same as on the OM-4) has an action that rivals that of the legendary M-series Leicas. The wind lever, while very good, is not quite in the same class. It's got a nice short stroke all right (130° plus 30° to stand-off position), its plastic tip is comfortably

contoured, and it's ratcheted so you can advance film in two or more strokes if you prefer. However, it lacks the nth degree of buttery smoothness, requiring a bit of an extra push in mid-stroke.

And how did we accommodate to this manual-only, match-needle machine after what seems like years of concentrating on auto-exposure SLRs? In general very well, thank you. We spent a day at the (stock car) races with the OM-3, a selection of teles and zooms and the Olympus Winder 2 (a very compact lightweight unit providing up to 2 fps on continuous run) and found that match-needle metering can be perfectly satisfactory with fast-moving subjects providing the light doesn't change with equal rapidity. Over 90% of our shots of the competitors taken in center-weighted mode were right on the money and spot readings of people in the grandstands were quick and accurate. Portraits shot at trackside proved the value of the OM-3's highlight and shadow modes delivering excellent results under very contrasty lighting conditions. About the only subject that made us wish we had auto-exposure capability was a cute little tyke darting around the hot dog stand—the (50mm f/1.4) lens was willing but the manual metering was too slow for this.

We like also the OM-3's exposure compensation system, settable in click-stopped  $\frac{1}{3}$  stop increments by turning (but not lifting) the film speed dial. The white-on-black scale is large and legible and when you set it for



## 35MM Single Lens Reflex

any degree of compensation a +- sign flashes slowly on the right-hand side of the LCD panel. On the other hand we were slightly miffed that the camera lacks a multiple exposure lever as found on other pro SLRs. The addition of that and the aforementioned mirror lock-up lever (desirable for vibrationless high magnification shooting with macros and long teles) would make an already very fine machine damn near perfect.

Will pros and the many advanced amateurs who claim to prefer doodad-less, mechanical workhorse SLRs be willing to pay a premium price (same as the high tech auto, multimode OM-4) for what is, after all, a match-needle metering camera? Given its sophisticated, superbly controllable metering system, its overwhelming mechanical solidity, "fail-safe" all mechanical shutter and excellent ergonomics, we predict that many will. In fact, it took Olympus nearly two years to get the OM-3 from the introduction to the actual production stage and it's been in short supply ever since. Evidently, Olympus is quite serious when they call it a "limited production" model, and in our judgment it's one that's well worth waiting for. (November 1985)

### 50mm f1.4 ZUIKO

**Specifications:** 50mm f1.4 Zuiko Auto-S No. 1140088, in Olympus OM mount; accepts 49mm filters; f/1.4-16, full stop depths; min. foc. dist. 1 1/2 ft. (0.45m); \$170.00.

**Practical comments:** Focus from infinity to min. distance in smooth, just-under-180 degree turn of 1/2-in.-wide textured collar. Grip-

pable, 3/16-in. wide aperture ring has large, legible white-on-black metric distances, orange-on-black footages. Depth-of-field scale calibrated for only three apertures: f/4, f/8, f/16. Built-in depth-of-field preview button.

**Field test slides:** Transparencies were crisp and snappy overall with fine detail well rendered. Center-to-corner sharpness consistent throughout aperture range. Slightly soft images with slight falloff in illumination in corners wide open both improving noticeably by f/2. Overall, somewhat above average performance for a high speed normal lens.

**Optical bench report** (for optical experts only): On axis, very slight overcorrected spherical aberration; very slight red flare gone by f/5.6; diffraction limited pattern by f/5.6.

Off axis, slight skew-ray flare mixed with very slight astigmatism, both virtually gone by f/5.6. A minimal amount of lateral color present throughout.

## OLYMPUS OM-4T: MORE THAN JUST A TITANIUM- ARMORED SLR

**MANUFACTURER'S SPECIFICATIONS:** Olympus OM-4T 35mm single-lens reflex, Body no.1126042. **LENS:** 50mm f/1.4 Zuiko Auto-S in interchangeable bayonet mount, No.1140088, apertures to f/16, focus to 18 in., accepts 49mm accessories. **SHUTTER:** Electronically controlled cloth focal plane with speeds from 240 sec. to 1/2000 sec. (manual speeds from 1 sec., mechanical speed 1/60 sec. and B), X sync to 1/60 sec., electronic self-timer. **VIEWING:** Non-interchangeable eye-level prism with central split-image range-finder, microprism collar, full-area interchangeable focusing screen. **OTHER FEATURES:** 3-volt battery-powered silicon blue cell metering circuit. Dual concentric silicon cell in mirror chamber measures either centerweighted area or 2% spot in center of picture area from light transmitted through the mirror, from the first shutter curtain, and/or the film during exposure; ISO/ASA 6-3200, TTL autofocus, Super FP Full Synchro flash with F280 flash (see text), aperture-prefixed autoexposure, with metered manual control; LCD linear shutter speed scale in finder shows centerweighted exposure, up to 8 spot readings with calculated average exposure, exposure memory hold with LED warning, highlight- and shadow-favoring exposure shifts, overexposure warning, flash ready, O.K., under- and overexposure flash warnings, autoexposure compensation indication, full manual exposure control in centerweighted and spot metering modes, built-in variable diopter eyepiece correction, battery check, beeper warning signal with on-off switch, weather-resistant body construction, film box end holder, accepts data back, hand grip auto-winder and motor, bulk film back. **PRICE:** \$1,005 with 50mm f/1.4 Zuiko lens; \$1,119 with 50mm f/1.2 Zuiko; \$920 with 50mm f/1.8 Zuiko; \$810 body only. When the Olympus OM-4, with its unprecedented multi-spot automatic metering sys-

tem and through-lens OTF autofocus control was introduced in 1984, there seemed to be little to add. True, the OM-3 was brought forth a bit later to give traditionalists and photographers working in tough climatic conditions a camera that combined the simplicity of the mechanical shutter-equipped Olympus OM-1 and the electronic sophistication of the OM-4's multi-spot and center-weighted metering system with LCD readouts (modified, of course, for this manual metering camera).

What, then, is the rationale for announcing the new OM-4T, essentially a revised OM-4 clad in titanium armor? The reasons, and the many changes, go deeper than the metallic sheen of the OM-4T's protective body. Olympus has updated the T's circuitry to improve reliability in harsh climates (especially humid ones, the bane of electronically controlled cameras) and made several notable detail improvements.

The most obvious addition is the unique Olympus Full Synchro flash system, also found in the OM-77AF. It's the only automatic fill-in flash system providing flash sync up to 1/2000 sec.

Of course the OM-4T started out as an OM-4 (which continues in the line), so we won't spend a lot of time rehashing what we've already said about the OM-4 (see "Modern Tests," May, 1984). If you need to refresh your memory on the features of the OM-4, send a self-addressed number 10 envelope with 56 cents in stamps to Readers' Service, MODERN PHOTOGRAPHY, 825 7th Ave., New York, NY 10019. Now let's take a closer look at the OM-4T and see what's really new.

You've probably seen references to titanium, the space-age wonder metal used in aircraft and satellites for some years. It's stronger and more rigid than steel, lighter than aluminum, and more corrosion resistant than either. It's also quite difficult (read expensive) to work with and to fabricate into precision camera body parts. Olympus is not the first to use titanium to beef up a camera body. That honor goes to Nikon for the F2T in the late '70s. Olympus' OM-4T uses titanium in its top and bottom plates (the back is steel) to protect delicate electronic circuitry and mechanical parts from shock or breakage. The price increase entailed is a relatively modest \$150 (\$810 for the OM-4T body, compared to \$660 for an OM-4 black body), and even with all the other changes, the actual body of the titanium camera weighs in at nearly one full ounce lighter than the OM-4.

Enhancing the performance of this super-rugged camera are body seals described by Olympus as shower proof and shock resistant, second-generation flexible printed circuit boards designed for easier access for repairs. The modified electronic circuitry is said to be more energy efficient (as well as accommodating the F280 Full Synchro flash).

Other changes are small, but appreciated. The hard-to-grip film-speed setting dial has been enlarged for easier manipulation and the concentrically mounted exposure override control now turns in either direction with equal facility. Evidently some people had trouble with the OM-4's self-timer/beeper squelch switch on the camera front. It now locks positively, yet can be easily unlocked and turned with a gloved finger, even with the high-speed motor drive mounted. Just push the bezel surrounding the red LED

### PERFORMANCE

| Our Standard                                                                      | as Tested     |
|-----------------------------------------------------------------------------------|---------------|
| <b>Focal length:</b> ±5%<br>(47.50-52.50mm)                                       | 50.94mm       |
| <b>Aperture:</b> ±5%<br>(f/1.33-1.47)                                             | f/1.45        |
| <b>Distortion:</b><br>(±1.5%)                                                     | 0.9% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(-0.15 stops) | 0.9 stops     |

### RESOLUTION

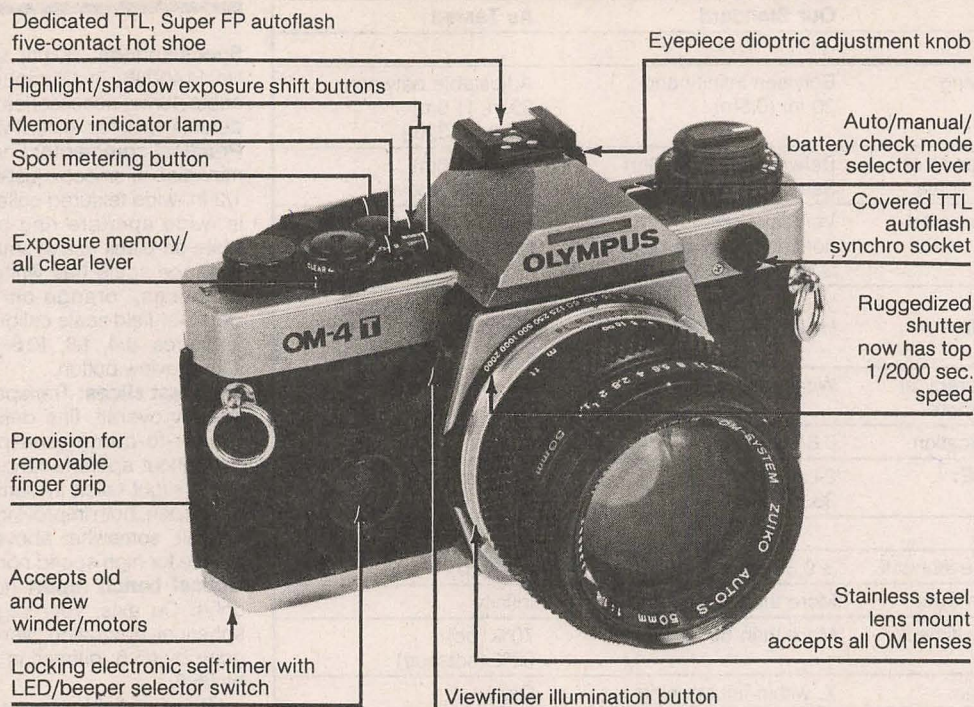
| ZUIKO 50mm f/1.4<br>at 1:49 |                      |    |                      |    |
|-----------------------------|----------------------|----|----------------------|----|
| f/                          | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 1.4                         | V. Good              | 55 | Excellent            | 49 |
| 2                           | V. Good              | 62 | Excellent            | 55 |
| 2.8                         | Good                 | 62 | V. Good              | 55 |
| 4                           | V. Good              | 69 | Excellent            | 62 |
| 5.6                         | V. Good              | 69 | Excellent            | 62 |
| 8                           | V. Good              | 69 | Excellent            | 62 |
| 11                          | V. Good              | 62 | Excellent            | 55 |
| 16                          | V. Good              | 62 | Excellent            | 55 |

### CONTRAST

| ZUIKO 50mm f/1.4<br>at 30 lines/mm |            |    |            |    |
|------------------------------------|------------|----|------------|----|
| f/                                 | Center (%) |    | Corner (%) |    |
| 1.4                                | Medium     | 41 | Medium     | 30 |
| 2                                  | Medium     | 45 | Medium     | 35 |
| 2.8                                | Medium     | 47 | Medium     | 40 |
| 4                                  | Medium     | 56 | High       | 45 |
| 5.6                                | High       | 59 | High       | 48 |
| 8                                  | Medium     | 57 | Medium     | 42 |
| 11                                 | High       | 55 | High       | 41 |
| 16                                 | Medium     | 48 | Medium     | 33 |



## What's New At A Glance: Olympus OM-4T



up toward the camera top and it unlocks for easy turning. The battery check circuit has also been modified so that it cannot be left turned on but will shut off automatically after 30 sec.

In general the OM-4T handles almost exactly like the OM-4. In terms of fit and feel, it's one of the handiest SLRs in production. If you are used to the latter, only the gray, slightly grainy texture of the titanium top and bottom plates and their metallic feel will be noticeable. Finder readouts, control locations, and ergonomics all are almost the same. Also unchanged is the seemingly unsubstantial feel of the wind lever (which has nevertheless proven to be strong enough to withstand the rigors of professional use). In short, the OM-4T is every bit the same compact, quiet, flexible SLR the 4 was, but it is undoubtedly more robust.

The only change in the viewfinder is the substitution of a square green flash charge and exposure confirmation LED for the old lightning bolt. The new LED works with both Full Synchro and OTF autoflash systems.

The Olympus F280 Full Synchro flash system is, in many ways, the most exciting new feature in the "T." We've already described it in detail both in "SLR Notebook" (MODERN, August, 1986) and the Olympus OM-77AF test report (March, 1987). Undoubtedly its most novel capability is that it synchronizes at shutter speeds up to 1/2000 sec. when set to Super FP mode, permitting automatic fill-in flash at close distances. However, its normal mode provides the proven advantages of TTL, off-the-film (OTF) flash control at greater distances, but only at the standard (for cloth shutters) flash sync speed of 1/60 sec.

Here, in simplified form, is how the F280 flash works in Super FP mode. The flash discharge, instead of being concentrated in a single, high-powered burst of about one milli-second duration (or faster at close dis-

tances), is stretched into a series of ultra-short pulses—800 or so—packed into the full 1/30 to 1/60 sec. period it takes the focal plane shutter slit to move across the film plane. In effect it's similar to the long-burning, magnesium-filled FP (focal plane) flashbulbs popular in decades past. When the flash pulses throughout the entire exposure, it acts more as a continuous light source than as a flash of light. Like available light, it's measured by the camera's normal centerweighted OTF metering system, which closes the second shutter curtain the instant the mix of flash and natural light on the scene has produced the proper exposure.

In Super FP mode, you can use any shutter speed above 1/60 sec. and be assured of full flash coverage. (If you could use Super FP flash at speeds slower than 1/60 sec., it would flash for only part of the time the shutter was open, leading to possible underexposure. The camera does not allow this, and signals "under" if you attempt it.)

With the camera and flash set to manual mode, you can balance ambient light and flash exposures in the time-honored manner—working complicated guide number calculations and perhaps adjusting the flash-to-subject distance for full control. Instead, most users will elect to go to full OTF automatic flash for pictures where flash is the primary light source.

It would be unfair to consider the F280 as a main light source when it's set to Super FP mode. It is just not that powerful. When it is used with a focal plane shutter at higher speeds, only a portion of the total light output even reaches the film. This is because the slit narrows as the shutter speed gets faster. Only at closer distances and lower shutter speeds, 1/60 to 1/125 sec., do you get enough light to expose a subject by flash alone in Super FP mode. (see chart, p. 48, original report).

Although illumination provided by the

F280 flash is constant in FP mode, the amount of fill can be controlled relative to ambient light by selecting higher or lower shutter speeds. This is accomplished by changing the lens aperture in automatic mode. If you set a lower shutter speed, the amount of fill-in flash will be greater. Moving above 1/250 sec. will darken the shadows (as well as freezing the action and minimizing depth of field). Although background exposure will remain correct, there is no automatic way to determine what would be the proper fill-to-ambient-light ratio for each subject. Often this is a matter of taste or personal preference. Although there are no hard and fast rules for obtaining optimal balance, with a little experimenting you should quickly get a feel for it.

We shot dozens of slides with and without the flash-fill operating and, as we had expected, found the effect greater when the subject was closest to the camera. Portraits and shots of couples showed the most effect. Fill flash on groups of people at 10–15 ft. was ineffective. But lighting for groups is difficult in any case. Besides, small dark shadows have little effect on our perception of most large, distant subjects, but are often quite annoying in a head-and-shoulders portrait. We found the fill flash most effective when we kept shutter speeds relatively low, but above 1/60 sec., and worked close with moderate teles or shorter focal length lenses.

We are looking forward to seeing the Super FP system evolve. This type of illumination from more powerful flashes with larger condensers yielding increased working range would be ideal. Greater control could be obtained with Super FP and current OTF flash systems by adding a variable flash output control and allowing the cameras to use OTF flash at speeds below 1/60 sec. as well (as in the original OM-2). A tilting head would also be desirable for bounce lighting



## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                                                                                                                                                                  | As Tested                                       |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                                                                                                                                                               |                                                 |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                                                                                                                            | Adjustable between 39 in. (1.0m) 13 in. (0.33m) |
| Apparent distance of shutter-speed scale | Between 79 in. (2.0m) Same as above                                                                                                                                                                                                                           | 39 in. (1.0m) Same as above                     |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                                                                                                                                                     | Vertical: 97% Horizontal: 93%                   |
| Parallax error compared to film          | Vertical: 0.3mm Horizontal: 1.3mm                                                                                                                                                                                                                             | Vertical: 0.2mm (up) Horizontal: 0.1mm (left)   |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                                                                                                                         | No discrepancy                                  |
| Image magnification                      | 0.84X ± .1X                                                                                                                                                                                                                                                   | 0.88X                                           |
| <b>PICTURE SIZE:</b>                     | 24 ± 0.6mm X 36 ± 0.9mm                                                                                                                                                                                                                                       | 24.0mm × 36.2mm                                 |
| <b>SHUTTER:</b>                          |                                                                                                                                                                                                                                                               |                                                 |
| Curtain travel evenness                  | ± 0.33 stop                                                                                                                                                                                                                                                   | 0.1 stop                                        |
| Insulation from sync                     | More than 7 megohms                                                                                                                                                                                                                                           | Infinity                                        |
| Sync contact efficiency                  | More than 60%                                                                                                                                                                                                                                                 | 70% (pc) 62% (hotshoe)                          |
| Sync delay time                          | X: within full opening                                                                                                                                                                                                                                        | Okay                                            |
| Shutter curtain bounce                   | Not allowed                                                                                                                                                                                                                                                   | None                                            |
| Self-timer delay                         | 7-15 sec.                                                                                                                                                                                                                                                     | 12 seconds                                      |
| <b>CAMERA NOISE:</b>                     | 65 dB(a), same as OM-4, typical for today's manual focus SLR                                                                                                                                                                                                  |                                                 |
| <b>CAMERA SIZE:</b>                      | Body: 5 <sup>7</sup> / <sub>16</sub> in. wide × 3 <sup>7</sup> / <sub>16</sub> in. high × 2 <sup>3</sup> / <sub>16</sub> in. deep (137 × 87 × 55mm)<br>Lens: 1 <sup>9</sup> / <sub>16</sub> in. long, 2 <sup>5</sup> / <sub>16</sub> in. diameter (40 × 60mm) |                                                 |
| <b>WEIGHT:</b>                           | Body: 1 lb. 2 <sup>1</sup> / <sub>4</sub> oz. (517g) with batteries<br>Lens: 7 <sup>11</sup> / <sub>16</sub> oz. (218g)                                                                                                                                       |                                                 |

in normal auto OTF mode. However, with the accessory TTL Auto Cord F0.6m, the F280 can be used off the camera or tilted for bounce lighting. Although the output in Super FP mode is not sufficient for extensive use of bounce techniques, the F280 certainly has enough power for bounce in the TTL or manual mode. Although the OM-4T was designed with the F280 in mind, the Auto Cord connects the F280 flash's 7-contact locking socket with the accessory shoe. The OM-4T's 5-contact body socket is dedicated to the older but still available T32 flash and its cord system. You can't mix the two systems because of differences in their triggering delays. Super FP sync occurs earlier in the shutter travel than normal X sync.

Beginning with the OM-2, the Olympus SLRs have been almost ideal designs from the light metering point of view. The audacious OTF light metering system that debuted in the OM-2 was revolutionary in its accuracy and effectiveness. The OTF flash metering system was an equally important revolution in the same body. As the design evolved, the OM system has become a comprehensive lighting control system. The T-32 multiple OTF flash system, with its myriad of ingenious close-up accessories, marked the next step—camera and flash system began to be thought of as an integral unit. Once you perfect exposure control, there's only one

place to go; you must control the lighting. No matter how brilliantly a picture is exposed, it will fail if the lighting is too contrasty and unflattering to begin with. That is why the Full Synchro flash system on the OM-77AF and the OM-4T entailed the next logical step—the automatic light-emitting camera.

The OM-4T, as the professional level companion to the "broad spectrum" OM-77AF, has been cleverly designed to provide convenience along with the control a discriminating amateur or pro needs for precise results.

We wouldn't be surprised to see the OM-4T eventually replace both the OM-4 and the OM-3, since it is virtually as dependable as the latter and even more comprehensive than the former. Its enhanced ruggedness and reliability under humid working conditions are bound to appeal to its intended audience of sophisticates. Although the OM-4T is clearly a more evolutionary design than some of its illustrious predecessors, its underlying philosophy is timeless. By building a ruggedized camera with sealed electronic components that equal or surpass the reliability of mechanical systems, Olympus has succeeded in making the OM-4T a "better OM-4." And remember, the original OM-4 was—and is—a pretty darn good camera to begin with. (June 1987)

## 50mm f/1.4 ZUIKO

**Specifications:** 50mm f/1.4 Zuiko Auto-S No.1140088, in Olympus OM mount; accepts 49mm accessories; f/1.4–16, full stop detents; min. foc. dist.: 1<sup>1</sup>/<sub>2</sub> ft. (0.45m); \$195.

**Practical comments:** Focus from infinity to min. dist. in smooth, just-under-180° turn of 1/2 in.-wide textured collar. Grippable, 3/16 in.-wide aperture ring has large, legible white-on-black scale; small but satisfactory distance scale has white-on-black metric distances, orange-on-black footages. Depth-of-field scale calibrated for only three apertures—f/4, f/8, f/16. Built-in depth-of-field preview button.

**Field test slides:** Transparencies crisp and snappy overall, fine detail well rendered. Center-to-corner sharpness consistent throughout aperture range. Slightly soft images, slight falloff in illumination in corners wide open, both improving noticeably by f/2. Overall, somewhat above average performance for high speed normal lens.

**Optical bench report** (for optical experts only): On axis, very slight overcorrected spherical aberration; very slight red flare, gone by f/5.6; diffraction limit was reached by f/5.6.

Off axis, slight skew-ray flare mixed with very slight astigmatism, both virtually gone by f/5.6. A minimal amount of lateral color present throughout.

## PERFORMANCE

| Our Standard                                                                      | as Tested     |
|-----------------------------------------------------------------------------------|---------------|
| <b>Focal length:</b> ±5%<br>(47.50-52.50mm)                                       | 50.94mm       |
| <b>Aperture:</b> ±5%<br>(f/1.33-1.47)                                             | f/1.45        |
| <b>Distortion:</b><br>(± 1.5%)                                                    | 0.9% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.9 stops     |

## RESOLUTION

ZUIKO 50mm f/1.4  
at 1:49

| f/  | Center (l/mm) | Corner (l/mm) |              |
|-----|---------------|---------------|--------------|
| 1.4 | V. Good       | 55            | Excellent 49 |
| 2   | V. Good       | 62            | Excellent 55 |
| 2.8 | Good          | 62            | V. Good 55   |
| 4   | V. Good       | 69            | Excellent 62 |
| 5.6 | V. Good       | 69            | Excellent 62 |
| 8   | V. Good       | 59            | Excellent 62 |
| 11  | V. Good       | 62            | Excellent 55 |
| 16  | V. Good       | 62            | Excellent 55 |

## CONTRAST

ZUIKO 50mm f/1.4  
at 30 lines/mm

| f/  | Center (%) | Corner (%) |           |
|-----|------------|------------|-----------|
| 1.4 | Medium     | 41         | Medium 30 |
| 2   | Medium     | 45         | Medium 35 |
| 2.8 | Medium     | 47         | Medium 40 |
| 4   | Medium     | 56         | High 45   |
| 5.6 | High       | 59         | High 48   |
| 8   | Medium     | 57         | Medium 42 |
| 11  | High       | 55         | High 41   |
| 16  | Medium     | 48         | Medium 33 |



## OLYMPUS OM77AF: VIRTUALLY A POINT-AND-SHOOT AUTO FOCUS 35mm SLR

### MANUFACTURER'S SPECIFICATIONS:

Olympus OM77AF autofocus 35mm single-lens reflex camera. Body No. 1017654. **LENS:** 50mm f/1.8 AF Olympus in OM AF bayonet mount. **SHUTTER:** Electronically controlled vertical travel Copal metal and plastic blade with speeds from 2 to  $\frac{1}{2000}$  sec. **EXPOSURE SYSTEMS:** User-changeable wide angle, normal and tele lens automatic shifting programs; silicon blue cell in side of mirror chamber reads centerweighted metering pattern from gray reflecting first set of shutter blades and/or film surface during exposure for existing light exposure measurement, from film only for TTL flash measurement; aperture-preferred autoexposure only with standard OM Zuiko lenses. **Metering sensitivity** EV 1-20 at ISO/ASA 100 with f/1.8 AF lens; auto DX film coding ISO/ASA 25-3200, autoexposure hold button, exposure reset button. **AUTOFOCUS:** Honeywell TCL phase detection CCD module in mirror chamber receives TTL image reflected from secondary mirror hinged behind central semi-silvered spot in rapid return mirror; single or continuous autofocus capability via integral AF motor, EV4-18 at ISO/ASA 100, built-in autofocus illuminator, auto-focus hold, manual power focus. **FLASH:** Six-pin dedicated hot shoe provides off-film flash measurement at  $\frac{1}{100}$  sec. f/4 with all standard Olympus-dedicated TTL flash units with addition of automatically switched Super FP flash sync from  $\frac{1}{100}$  to  $\frac{1}{2000}$  sec. using F280 Olympus flash; f/4 at  $\frac{1}{100}$  sec. setting for non-TTL flash units; provision for flashmatic system with Power Flash Grip 300. **VIEWFINDER:** Fixed eye-level prism with non-interchangeable screen having central auto-focusing rectangle, full focusing screen. Single silicon cell above eyepiece measures light from focusing screen for viewfinder information. LEDs behind finder information panel provide illumination for the following: LCD digital shutter speeds, apertures, autofocus or power focus modes, separate flash ready and confirmation check indicators for regular TTL and Super FP flash; over/underexposure warning signals, green/red autofocus OK/not possible circle, power focus, single or continuous focus and warning; cancellable 12 sec. electronic self-timer with blinking indicator, contoured thumb rest, on-off power switch, provision for data back. **BATTERIES:** All power supplied by four AAA alkaline energizers in interchangeable Power Flash Grip 100 or Power Flash Grip 300, the latter having pop-up flashmatic flash and built in ready light. **PRICE:** \$575 with 50mm f/1.8 lens and Power Flash Grip 300.

Any lens-shutter point-and-shoot enthusiast who is looking beyond a point-and-shoot camera for an SLR that nears point-and-shoot simplicity yet provides a full line of in-

terchangeable lenses can stop at the OM77AF. Attach the Power Flash Grip 300 with its pop-up flash (furnished with the OM77AF) and you have virtually the same auto-everything features as the ubiquitous point-and-shoot lens-shutter camera. Now, however, the world of exposure-programmable wide angle, macro, tele and zoom lenses is yours, as well as TTL measuring flash with accessory flash units. For owners of other Olympus OM cameras, add the possibility of attaching regular Olympus mount lenses for autoexposure, if not for autofocus operation.

Does this indicate the OM77AF is strictly for tyros? While the camera definitely does lean in that direction, it can provide enough exposure information and control to satisfy many more advanced SLR photographers looking for a simpler and more convenient life than most SLR outfits allow. Additionally, it has a number of attractive advanced features found in other autofocus 35mm SLR camera: electronic flash capability at all shutter speeds for better fill-in flash control and a built-in low light level autofocus illuminator.

The body form of the OM77AF follows what now may be considered the usual build for a modern SLR with built-in internal autowinder: a somewhat elongated black body with battery containing handgrip, having a contoured thumb rest at the back. The grip can be removed to take advantage of a choice between the Power Flash Grip 300, housing its own pop-up flash (more about that later), and a plainer Jane Grip 100 without flash. Four AAA cells nestle within in the rubberized surface grip. The instructions don't say you can't use nicad batteries, but Olympus technicians say "no" and have engineered compartment contact shoulders to prevent such use (which MODERN'S GE nicads, however, cleverly bypass). The removable battery compartment grip suggests that Olympus may plan on making available other potential power sources, such as a lithium powered grip in the future.

Press in a small black button on the left edge of the camera and slide the opening latch down. The removable back (interchangeable data back coming) swings open. You insert a DX-coded cartridge in the left-hand film chamber. There is no provision for manual film speed setting so the film must be DX coded or the camera will default to an ISO/ASA 100 setting, no matter the true film speed. This is OK if the non-DX coded film is indeed 100 but not so good if it is another speed. (Fortunately almost all regularly used films of all brands today are now DX coded.) Pull the leader across to the arrow near the takeup spool and shut the back, much as in other autoloading cameras, immediately the internal motor advances the film three times to the first frame with noticeable but not obtrusive whirr. The LCD panel atop the camera shows a pictograph of film correctly loaded: a "1" (for frame 1) appears; so do the designations "program" and "AF" in a box (indicating the camera is in the autofocus mode) with the adjacent word "single," meaning that the camera will shoot single shots and autofocus only once. Should you have failed to load the film correctly the pictograph would show a film cartridge without a withdrawn leader. After the last exposure on the roll, the tension against the film end attached inside to the cartridge spool causes a blinking "R" to appear inside

## 35MM Single Lens Reflex

the cartridge pictograph on the LCD panel. Rewinding is now in order. Turn the camera over, push the rewind lever in the direction of the molded arrow on the lever and push in the rewind button. Rewinding will begin (a 24 exposure cartridge takes 17 sec.). Film will be rewound completely into the cartridge and rewinding will cease.

After loading the OM77AF, push the convenient power switch forward with your right thumb and hold the camera to your eye. Press lightly on the nicely placed, slightly angled, largish shutter release button on the power grip. In the finder you will see a bright viewing screen, which Olympus calls a Super Lumi-Micron Matte screen. To our eyes, it's about a full f/stop brighter than the previous Olympus screens, although comparisons are hard since the OM77AF's finder magnification is slightly less than that on most of the other OM cameras: .8X as opposed to .84X.

At left in the viewfinder, partially intruding into the picture area (but not annoyingly so) is a black information panel. Bright, segmented, green digital shutter speeds and apertures appear within panel windows against a grayish-green background. These are LCD numerals lit from behind by LEDs. The speed indications visible, which appear individually of course, are generous in range, representing 2, 1,  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ ,  $\frac{1}{6}$ ,  $\frac{1}{8}$ ,  $\frac{1}{10}$ ,  $\frac{1}{20}$ ,  $\frac{1}{30}$ ,  $\frac{1}{45}$ ,  $\frac{1}{60}$ ,  $\frac{1}{90}$ ,  $\frac{1}{125}$ ,  $\frac{1}{180}$ ,  $\frac{1}{250}$ ,  $\frac{1}{350}$ ,  $\frac{1}{500}$ ,  $\frac{1}{750}$ ,  $\frac{1}{1000}$ ,  $\frac{1}{500}$ , and  $\frac{1}{2000}$  sec. Aperture indications are also well represented: 1.8, 2, 2.5, 2.8, 3.5, 4, 4.5, 5.6, 6.7, 8, 9.5, 11, 13, 16, 19, 22.

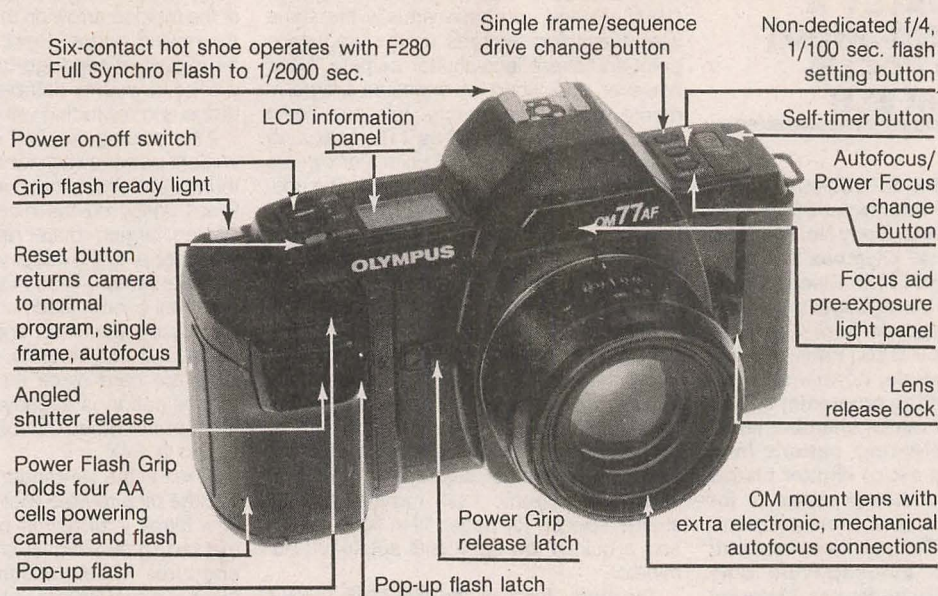
This camera with its AF lenses operates in program mode only, selecting combinations of apertures and shutter speeds. One of three separate programs is automatically selected, depending on the focal length of the AF lens you're using: a wide angle program favoring depth over shutter speed for lenses below 35mm, a "normal" program for lenses from 35mm to 85mm and a tele program favoring higher shutter speeds to prevent camera shake for lenses of 90mm or more. Zoom lenses change programs as you change focal lengths. If there is less light than an exposure at two sec. can manage at full aperture, the indication "Lo" starts flashing in the shutter speed panel. If light is impossibly right, beyond  $\frac{1}{2000}$  at f/22 the  $\frac{1}{2000}$  sec. digits blink in this unlikely situation.

Are you then hopelessly wedded to the shutter speed and aperture chosen by the camera's metering system? No. you can easily shift the shutter speed and aperture program yourself and create your own program. For instance, suppose the viewfinder panel indicates  $\frac{1}{250}$  sec. at f/4 but you prefer a smaller aperture for greater depth of field. A single push left on the program shift lever at the back of the camera, conveniently close to your right thumb, gives you  $\frac{1}{80}$  sec. at f/4.5 while a second push would change exposure to  $\frac{1}{125}$  sec. at f/5.6 and another press would deliver  $\frac{1}{90}$  sec. at f/6.7. In like manner, should you prefer faster shutter speeds and less depth of field, one push right of the lever would have yielded  $\frac{1}{350}$  sec. at f/3.5 and a second,  $\frac{1}{500}$  sec. at f/2.8.

Once you have shifted the program, it will remain on its new program course, showing whatever preference shift you have adopted. During the program shift, the word "program" on the top-of-camera LCD panel will



## What's New At A Glance: Olympus OM77AF



blink to remind you that you are not using the standard program. The OM77AF can be returned to the original program by: a) pressing the green reset button atop the camera; b) turning off the main power switch and then turning it on again; or c) by waiting 30 sec. after the initial shutter release pressing. Power will automatically be turned off to conserve the battery. Pressing the shutter release slightly will return you to the original program.

Shifting the program does allow you to change to whatever shutter speed or aperture you wish, somewhat akin to having shutter- or aperture-preferred autoexposure modes. But it doesn't alter the actual exposure, since all the aperture-shutter speed couplings provide the same exposure. However, there is an autoexposure locking button at the back of the camera. By pressing this and holding it in, you can make close-up exposure readings of such difficult subjects as a heavily backlit person or object. You can then return to your original camera position, from which you can release the shutter using the close-up reading.

Shifting the program or using the AEL button may be sufficient exposure alteration for anyone using print film and standard photo-finishing only, since automatic printers will compensate for exposure variations of two or more f/stops and turn out identical prints anyhow. However if you're a slide film user, you may want to bracket exposure or alter exposure in difficult lighting conditions. You can't do so since the camera does not have any manual exposure mode, manually set ISO/ASA film speed dial or autoexposure correction feature. However, for all print film use and even for average slide picture-taking situations, the OM77AF will yield good exposures.

Directly above the shutter speed and aperture windows on the finder information panel is a round circle in which autofocus information appears. Slightly more pressure on the shutter release causes the OM77AF's

autofocus system to operate. The autofocus motor located in the camera body turns a key on the body lens mount. This key fits a matching slot on the back of each OM AF lens, in a manner similar to the autofocus systems of the Minolta Maxxum and Nikon 2020 cameras. When the CCD module in the camera's mirror chamber indicates proper focus has been achieved, autofocusing stops. The viewfinder circle turns green if the camera has autofocused on the subject correctly or red if the autofocus system cannot autofocus properly. Insufficient light on the subject, central subject at varying depths, subjects with repeating patterns (such as a picture with many apartment house windows), subjects without much contrast or vertical lines, or rapid action subjects coming directly towards the camera may not be autofocusable and will cause the red autofocus circle to light.

Such problems subjects are difficult or impossible for any present autofocus SLR to handle by itself. But the OM77AF has a focusing aid built into the body for low light levels. In regular operation the camera can autofocus on average subjects in light as low as EV4, which, with a 50mm f/1.8 lens, works out to be 1/4 sec. This is quite a good performance. But the camera can autofocus in even lower light. Below EV4, a red LED lamp behind a red panel next to the OM77AF nameplate above the lens turns on for approximately 1/4 sec., projecting a light pattern on the subject. In that 1/4 sec. the autofocusing system focuses on the subject even if the subject has little contrast. Exposures can therefore be made down to two sec. at full aperture. Our tests indicate that the built-in focus aid can operate on average subjects as far away as 29 ft. If the subject is very dark, of course, the range is more limited.

While a focus aid light is not new (they have been built into autofocus camera accessory flash units to focus for flash pictures), the OM77AF is the only SLR with a

built-in-focus aid light for low existing light photography.

The autofocusing system has two modes: In single autofocus, the system focuses once until correct focus is found, such as on a person's face. It then locks but can be refocused if you let go of the shutter release and press the release again. In continuous focus, the autofocus will continue to focus and refocus on a subject such as a moving person. On the top plate of the OM77AF, on the left side, is a black button marked "drive." In normal position, the camera will shoot one frame when you press the shutter release and the camera will single autofocus. The word "single" appears on the top LCD panel.

When you press the button, it does two things. It allows the camera to make sequence photos and focus continually as long as the shutter release is pressed. The abbreviation "cont." (standing for continuous) appears on the LCD panel. While a single button does control these two separate features, the features are only partially dependent on each other. With slight shutter release pressure you can enjoy continuous focus only. With more pressure, which releases the shutter, you have sequence pictures plus continuous focus (which you certainly would need with any subject requiring sequence shooting).

Since there are subjects that defy autofocus, you must have a way of focusing the camera yourself—and you do. The camera has a unique method of providing manual focusing, called "power focusing." At the top left of the camera is yet another black button marked "AF/PF." In normal "AF" mode, the camera autofocuses. To use power focus, you press this button and you're ready for "PF," or power focusing. Pressing the PF/Program Shift lever to the right focuses the lens closer in small increments, at a continuous speed or higher speed depending on how far you push the lever. To focus at a greater distance, you push the lever to



the left. During power focus, a "PF" appears on the viewfinder panel, a blinking "PF" can be seen on the top plate LCD panel and the green autofocus circle pulses while power focus is actually taking place. You judge proper focus by checking the image on the viewing screen—there is no focus confirmation light. Pushing the AF/PF button a second time returns the camera to autofocus control.

At any time, you can also push the green reset button. While it's depressed you see film speed setting and the battery condition pictograph (more about that later). When you release the button, you are always back at the normal setting of program, single autofocus and single exposure. While we found the button conveniently situated, they are difficult to push without a good strong finger, or better still, fingernail.

Let's discuss lenses and lens mount compatibility before we go on to flashes. At present, besides the 50mm f/1.8, the following autofocus OM AF lenses are available: 28mm f/2.8, 35-70mm f/3.5-4.5 zoom and a 70-210mm f/3.5-4.5 zoom. Promised soon are a 28-85mm f/3.5-4.5 zoom, 35-105mm f/3.5-4.5 zoom, a 50mm f/2.8 and 24mm f/2.8 macro. While none of the OM AF lenses have aperture setting rings or manual focusing abilities, the OM AF lens mount configuration is very similar to the regular OM mount on the other Olympus SLRs. Thus all regular Zuikos (except the 500mm f/8, 600mm f/6.5 and 1000mm f/11) and bellows or extension tube accessories can fit the OM77AF. The Zuikos, however, cannot be autofocused, the shutter and aperture information will not appear in the OM77AF's viewfinder and the camera will not operate in program mode. Nevertheless, the auto diaphragm mechanisms will operate, you can focus manually on the focusing screen and the lenses can be used in regular aperture-preferred autoexposure mode by setting the lenses' aperture rings as you wish. But you won't know the camera-selected shutter speed. Conversely however, you cannot physically fit any of the OM AF Olympus lenses on any other Olympus OM camera. To make sure you don't try and thus break camera or lens, one lip of the PM AF lens mount has been made larger than the corresponding slot on other OM cameras' lens mounts.

The OM77AF flash system is very comprehensive. First, let's talk about the Power Flash Grip 300. Press the small latch on the right side of the camera towards the lens mount and you can slip the whole power grip off and replace it with the slightly smaller non-flash Power Grip 100 (\$25.). But you needn't remove the power grip to load or change batteries. The plastic bottom grip cover slides off and the four AAA alkaline cells load swiftly. To ready the flash, press a small latch on the inner wall of the grip. A 1x1/2 in. flash head pops up from the top of the grip. The flash will immediately start charging, provided the power switch is on and the finder information is visible. When ready to operate, the ready light at the rear of the Grip 300 will light. The flash operates only at speeds of 1/100 or slower. Above that speed the picture will be made by existing light only. At 1/100 sec. or lower existing light exposure speeds, the finder shutter speed panel continues to show 1/100 sec. sync speed. The Flash Grip 300 uses a highly efficient flashmatic type of flash autoexposure. The flash fires always at full power but the aperture is varied according to the dis-

tance of the subject. You can actually see the aperture numeral grow smaller by looking at the aperture window on the finder information panel. The closer the subject, the smaller the aperture. The exposure therefore is made independently of subject reflectance or coloration, a system championed by many flash enthusiasts as yielding far better flash results than the usual measurement of light reflected from the subject. The bottom window of the finder information panel shows a lightning signal when the Grip 300 flash is fully charged and, following exposure, a blinking signal if flash illumination was sufficient.

We now come to another unique and elegant feature of the OM77AF. Using the new Olympus F280 flash, the camera can sync at shutter speeds up to 1/2000 sec! For a novice or snapshooter who simply doesn't want to know anything technical, instructions to turn on the flash in all kinds of light will be sufficient. But for MODERN's more curious and knowledgeable readers, we'd better explain what's really going on with this deceptively simply but quite complex flash system.

In low light the F280 automatically sets itself to f/4 and 1/100 sec. as soon as the flash is turned on. (If the lens has a smaller maximum aperture than f/4, it will set to that.) The F280 then provides regular TTL off-the-film measuring autoflash. When existing light increases to required an exposure higher than 1/100 sec. at f/4, the F280 automatically switches to Super FP flash, allowing you to combine flash and existing light at all shutter speeds from 1/100 sec. to 1/2000 sec. The aperture, however, remains at f/4. Increases in existing light cause the camera shutter speeds to rise until 1/2000 sec. at f/4 is reached. If existing light continues to brighten, the shutter speed remains at 1/2000 sec. but the aperture closes down.

While a 1/2000 sec. sync speed sounds exciting, that speed alone would prove to have little use. The electronic flash pulse duration of almost all small flash units is already short enough to stop nearly every action. (For instance, the F280's normal off-the-film TTL flash sync durations range from 1/1000 sec. at far subject distances to 1/40,000 sec. close-up). What need is there for faster camera sync speeds then?

One flash bugaboo suffered by every full frame focal plane shutter SLR is the limitation in combining flash with existing light to fill in shadows or create highlights in shade or on dull days. With many other SLRs, figuring existing light and flash shutter speed and aperture combinations at flash sync speed or slower can be complicated or impossible. There is also the danger at slow sync speeds of obtaining one image from the flash and a secondary "ghost" image from existing light.

The sync speed limitation is caused by the shutter's need to be fully open when the single electronic flash pulse is emitted. If the shutter speed is faster, the moving slit of the focal plane shutter will only be partially open and only part of the film surface will receive the flash illumination.

To alleviate these problems, focal plane shutters have been redesigned and speeded up. As a result, sync speeds have risen on many focal plane shutter cameras over the years from 1/30 sec. to 1/60 sec., then 1/125 sec. and now, in a few, to 1/250 sec. under specific circumstances.

With the F280 there is no sync speed limitation. Rather than emitting one single high

peak electronic pulse of light, the F280 at shutter speeds over 1/100 sec. automatically changes to FP mode, emitting a series of nearly continuous lower peak pulses covering the time interval of focal plane shutter slit traversing the film width. This varies from 800 pulses at speeds just above 1/100 sec. to a relatively few pulses at 1/2000 sec. The number of flash pulses needed in Super FP flash depends on the camera shutter speed. The chart below indicates the distance range of Super FP flash.

**F280's SUPER FP FLASH  
WORKING DISTANCES**

| Shutter speed | Max. Working Distance |
|---------------|-----------------------|
| 1/100         | 13 ft.                |
| 1/125         | 9.3 ft.               |
| 1/250         | 6.3 ft.               |
| 1/500         | 5.3 ft.               |
| 1/1000        | 3.7 ft.               |
| 1/2000        | 2.7 ft.               |

At 1/2000 sec. you'll notice that the distance range with ISO/ASA 100 film is only 2.7 ft! But don't let that alarm you. Even with fast film and f/4, that shutter speed could only be needed in bright light when no flash, except one used very close, would have an effect. The chart also shows you the distances at which the flash illumination will equal the existing light for complete flash fill-in.

However at greater distances the flash will still provide fill-in. The farther the distance the less the fill-in, of course. However in most overhead sunlight cases the F280 should automatically eliminate all dangers of close shadowy faces and unpleasantly black eye sockets in groups and portraits, as well as providing bright close-ups even on dull days.

The OM77AF's off-the-film metering system determines the exact exposure based on the existing light and flash combination.

However if you think of the flash as an additional illumination to existing light rather than as a sole source of illumination as is the case with regular single pulse flash, you will quickly see that even a tyro can cheerfully keep his F280 flash on with good effect in close and mid-range picture-taking situations.

The F280 flash will operate on other Olympus SLRs and provide whatever flash sync features a dedicated Olympus flash should, for that particular camera model. However the F280 will not allow Super FP Flash except on the OM77AF and the OM-4T.

The F280, when fully-charged and shooting in its low light regular OTF TTL mode, shows a single lightning symbol in the viewfinder panel. If the unit is being used in light bright enough for the Super FP Flash mode, a double lightning symbol to the left of the single one lights instead. If there had been sufficient light for the picture, one or the other of the lightning symbols would blink after the shot was made.

The F280 flash covers the angle of a 24mm lens, has its own charging lamp plus dual OTF and Super FP mode lamps (which light following exposure to indicate what flash mode was used) but has no provision for bounce light. However, TTL autocord can be connected to the F280's autocord socket for off-camera use, including bounce flash.

Although the OM77AF has a built-in autofocus aid light as already noted, the F280 has a more powerful one to allow the camera



## 35MM Single Lens Reflex

to focus at distances up to 39 ft. (according to our tests) only prior to the flash's going off. When the F280's aid operates, the OM77AF's operates as well. Yes the Flash Grip 300 and F280 can be operated together and the exposure will be properly measured.

While the OM77AF's focus aid lights on camera and flash may appear to operate on the same manner as on the Minolta Maxxum and the Nikon autofocus flash units, they don't. The Maxxum and 2020 camera flash units emit a short, near infrared preflash with a pattern that the camera's autofocus mechanism can analyze and focus.

The OM77AF's focus aids, in camera and flash, act more like flashlights remaining on, virtually patternless, for about 1/2 sec. They illuminate the subject rather than act as pattern throwers. While the 2020AF and Maxxums may be able to focus on blank surfaces, which the Olympus' system can't, the longer illumination of the Olympus focusing aid lights do drain more juice from the batteries than the Maxxum or 2020 systems.

Incidentally, when the F280 flash is mounted on the camera, the focusing aid light of the flash operates in addition to the camera's own built-in aid light, even though the F280 flash isn't turned on. Using both aid lights together adds about 30% to the maximum useful distance; therefore it would make more sense and help conserve battery power to turn off the camera's own focusing aid when the flash unit is available and maximum distance isn't needed.

The 39 ft. focusing aid distance ability is hard to put to use at its far range in very low light. The focusable subject would have to be located precisely in picture center, a difficult task since you can't see the subject through the dim finder adequately. If the subject is large, like an elephant, then it will operate.

While the F280 flash will not allow you to set your own aperture in low light except at f/4, you can trick the flash system into other apertures by using the Power Flash Grip 300. If both the Grip 300 and F280 are turned on together, the F280 defers to the apertures set in Flashmatic mode by the Grip 300. You can therefore approach your subject at whatever distance you need to set that lens opening—f/2.8 at 16 ft. for instance. When you release the shutter, the camera will operate at the aperture you've chosen and the F280's quenching circuit will throttle down that unit's output to match that of the Grip 300 flash. Of course you are limited to the distance needed to use that particular Grip 300 flash aperture.

What about regular OM Olympus Zuiko lenses when mounted on the OM77AF as far as flash goes? You get regular 1/100 sec. flash sync and TTL off-film autoexposure at any aperture you set, provided the existing illumination will allow a shot at that speed and the aperture you choose. The flash ready and flash OK lighting signals will appear in the viewfinder.

Any other Olympus TTL dedicated flash unit can be used on the OM77AF and will provide regular off-the-film TTL flash measurement at f/4 and 1/100 sec. unless a smaller maximum aperture lens is used, in which case the lens will remain at its widest aperture.

You can't use a manual flash unit on the OM77AF, but any direct automatic flash with a single hot shoe contact will work. Just

press the F4 flash button atop the 77AF and use your direct automatic flash at that aperture.

In form and handling the OM77AF closely resembled the autofocus Nikon 2020, although the Nikon with its AAA cells tucked in the bottom was understandable slightly taller while the Olympus with batteries in the hand-grip was slightly longer. The OM77AF was easy to hold and grasp. The shutter release button—which more probably should be called the master control switch since it does control practically everything—falls nicely right beneath your right forefinger, while your right thumb nestles well at the rear against the rubber-like covering of the thumb rest.

Since this one switch does practically everything, we were somewhat worried that its three levels of pressure, 1) finder information on, 2) autofocus and 3) shutter release, would prove too fine for precise control. But even when wearing gloves, we were able to distinguish between the levels and operate all three with no difficulty (And how many cameras do you know that are operable with gloves?). The small buttons such as Reset, AF/PF, Drive and F/4 flash work best underneath a fingernail or hardened finger end or ball.

As far as autofocus was concerned, we found, as in other cameras having much the same autofocus systems: (e.g. the Minolta Maxxums and the Nikon N2020) that autofocus works most efficiently in bright light with difficulties only in handling subjects already noted. Given similar subject material, we found the OM77AF was equally efficient in focusing as present rival autofocus SLRs. The 50mm f/1.8 OM AF lens was able to autofocus from infinity to closest focusing point, 18 in. in 0-85 sec, which is judged to be average time.

Like other autofocus SLRs, the OM77AF in single focus mode could not be fired until correct focus was achieved. However, when switched to continuous focus (and sequence firing), the OM77AF would still only fire and advance film when the green focus correct indicator lit.

Photographers may be of two minds on this. In fast action, some might depend on depth of field to provide sufficient sharpness even if correct focus isn't achieved. Others might very well still prefer the assurance that the camera won't release in any autofocus mode unless it is certain the focus is correct. In our opinion, for the novice or snapshooter, the latter is probably preferable—and it is for the latter that this camera has been principally engineered.

In poor light, we were pleased with the help given by the focus aid light at the front of the prism housing. It actually allowed us to focus on difficult subjects in light lower than EV4 more easily than in slightly higher levels with no focus aid light. We would certainly recommend that future SLR designers incorporate, if possible, focus aid lights for use in any low light situation, flash or not.

When the autofocus circle turned red, indicating that autofocus was impossible and we couldn't change to a different, easier to focus, substitute subject area, we switched to power focus. We had turned up our collective noses at the thought of power focus, compared with simple manual focus. Manual focus would have allowed us to focus just by turning a lens focusing ring. Power focus definitely does take more battery power.

Secondly, the concept of pushing a lever to the right to focus in one direction and then to the left to reverse field sounds clumsy even if focus speed can be altered by pushing part way or all the way, like an accelerator pedal. Our conclusion after using the system: It works but it takes a bit of practice. Why did Olympus do it? We think to eliminate the bulk and construction of a focusing ring on each lens with the knowledge that few would-be purchasers of this camera would focus manually anyway.

The tyro user concept of the OM77AF is further carried through by the elimination of a depth-of-field preview (a common omission on many SLRs today), the absence of a long exposure setting such as T or B (probably seldom used by tyros anyway and certainly not present on lens-shutter point-and-shoot cameras) plus the elimination of a body PC contact (but substituted for by an off-camera, fully synched connecting cord for the F280 flash).

The most conspicuous lack, however, is the omission of a socket for a cable release or remote switch cable. You fire the camera from the shutter release and that's it—or is it? Aha, the electronic self-timer! For long shutter speeds, put the camera on a sturdy surface or tripod and use the self-timer. Again for tyros (and many others too) this method of releasing the camera shutter at slow speeds will be quite sufficient.

While we aren't reviewing the OM77AF zoom lenses, we did get an opportunity to try them so we could check out the feasibility of the exposure programs, which are changed according to lens focal length as already noted. The three programs seemed sensibly selected and we found no cause to establish programs of our own. We did try the program shift, using the thumb-actuated lever at the back of the camera, and found we could easily shift to the shutter or aperture we wanted by checking the exposure change in the view-finder.

While the view finder magnification has been reduced compared to other OM cameras, we judged the reduction inconsequential, when compared with the enormous gain in viewing ability when wearing eyeglasses. You can easily see the entire screen and informational panel with prescription eyeglasses.

The digital shutter and aperture numerals were large and clear, equal to or superior to those found on any other SLR and certainly easier to see than any other LCD numerals in dark picture-taking areas. The plain Go/No Go red or green autofocusing circle we found perhaps the easiest autofocus indicator available on an SLR.

Loading was trouble-free but we fumbled a bit with the bottom rewind lever and button until we got the hang of them. Still, a top-of-camera rewinding solution such as on the OM-4 would be appreciated.

The tension device that causes the R to appear at the end of the film roll worked spasmodically. The noise of the turning take-up sprockets slipping out of the film perforations warned us that we had reached the end of the roll and rewinding was in order.

We checked sequence shooting and found that the winder with fresh batteries fired a 36 exposure roll of film at 1/250-1/350 sec. in 31 sec. or 1.16 frames per sec. (fps) true winder speed. This is somewhat slower than the 1.5 fps approximated in the manufacturer's specifications but was more than



satisfactory for our purposes.

The tyro will find using the F280 flash as easy as using the flash on any point-and-shoot camera. Just wait for the flash to recycle and fire. If the confirmation light appears, you have the picture.

We too found flash with the F280 very convenient. While there are other SLR/flash unit combinations that do give more precise fill-in flash control, they require thought or calculation and sometimes both. The F280 sailed along in bright light, giving us good fill-in results at reasonable distances. In low light, the maximum f/4 aperture setting did limit our maximum flash distance when lenses with larger apertures were used. Maximum distance f/4 with ISO/ASA 100 film is given as 23 ft., which we found to be accurate.

You may be confused about which indicators you should check, following flash exposure, to find out if the flash was sufficient and when the unit is ready to fire again. There are indicator lights on the flash unit and in the camera finder. The lightning indicators in the finder are the most convenient and appeared to be the most accurate.

The Power Flash Grip 300 was a convenient delight, since its flash was ever present. We calculated its 12 guide number in meters for ISO/ASA 100 film to be the equal of 40 in feet. We then could double that with ISO/ASA 400 film. This provided us with the ability to reach an astounding distance of 40 ft. at f/1.8 aperture. Pictures were quite acceptable in average reflectance conditions, although pictures such as people standing in large auditoriums were understandably slightly underexposed when slides were made, and would have been better served with the F280 flash, which measures reflectance directly from the subject. Print film, however, delivered good results in the auditorium because of its wider latitude than slide material.

With fresh batteries the Flash Grip 300 initially takes about 10 sec. to charge and recycles thereafter again in about 10 sec. Estimating how many flashed you can get on one set of batteries becomes rather complex since the same four AAA alkaline energizers not only furnish flash power but also power autoloading, autowinding, autorewinding, autofocus, power focus, the rapid return mirror mechanism, the exposure system and the focusing aid light. Logically the more the camera must do of one thing, the less the batteries can accomplish in other directions. Outdoors with quick autofocus, the one set of batteries can undoubtedly power the camera as per the instruction book for as many as 25 rolls of 24 exposure film. But add 50 of the pictures made with flash and the suggested number falls to eight rolls. If you use flash all the time in low light, continuous autofocus and the focusing aid, the number of 24 exposure rolls can come crashing down as low as two or three per set of batteries.

The camera does have a battery check system. Press the green reset button and a battery pictograph appears showing a battery full or half full and blinking. When the battery power is half full or less the battery pictograph will blink on the LCD panel even when the green button isn't pressed. Half full is the indication that you have less than 50% battery capacity and should replace the batteries unless you're prepared to run the batteries to the point of camera stoppage. At

| GENERAL PERFORMANCE                      |                                                                                                                                                                                                                         |                                                   |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Checkpoints                              | Our Standard                                                                                                                                                                                                            | As Tested                                         |
| <b>FINDER:</b>                           |                                                                                                                                                                                                                         |                                                   |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                                                                                      | 32 in. (0.8m)                                     |
| Apparent distance of shutter-speed scale | Between 79 in. (1.3m) and 22 in. (0.6m)                                                                                                                                                                                 | 39 in. (1.0m)                                     |
| Apparent distance of aperture scale      | Same as above                                                                                                                                                                                                           | 39 in. (1.0m)                                     |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                                                                                                               | Vertical: 93%<br>Horizontal: 92%                  |
| Parallax error compared to film          | Vertical: 0.9mm<br>Horizontal: 1.5mm                                                                                                                                                                                    | Vertical: 0.2mm (up)<br>Horizontal: 0.1mm (right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                                                                                   | No discrepancy                                    |
| Image magnification                      | 0.80X $\pm$ .1X                                                                                                                                                                                                         | 0.80X                                             |
| <b>PICTURE SIZE:</b>                     | 24 $\pm$ 0.6mm X<br>36 $\pm$ 0.9mm                                                                                                                                                                                      | 23.7mm X 36.5mm                                   |
| <b>SHUTTER:</b>                          |                                                                                                                                                                                                                         |                                                   |
| Curtain travel evenness                  | $\pm$ 0.33 stop                                                                                                                                                                                                         | 0.1 stop                                          |
| Insulation from sync                     | More than 7 megohms                                                                                                                                                                                                     | Infinity                                          |
| Sync contact efficiency                  | More than 60%                                                                                                                                                                                                           | 70% (hotshoe)                                     |
| Sync delay time                          | X: within full opening                                                                                                                                                                                                  | Okay                                              |
| Shutter curtain bounce                   | Not allowed                                                                                                                                                                                                             | None                                              |
| Self-timer delay                         | 7-15 sec.                                                                                                                                                                                                               | 12 seconds                                        |
| <b>CAMERA NOISE:</b>                     | 65 dB(a), quiet for a motorized AF SLR                                                                                                                                                                                  |                                                   |
| <b>CAMERA SIZE:</b>                      | Body: 6 $\frac{3}{8}$ in. wide $\times$ 3 $\frac{9}{16}$ in. high $\times$ 2 $\frac{5}{8}$ in. deep (162 $\times$ 90 $\times$ 67mm)<br>Lens: 1 $\frac{1}{4}$ in. long, 2 $\frac{7}{16}$ in. diameter (32 $\times$ 62mm) |                                                   |
| <b>WEIGHT:</b>                           | Body: 1 lb. 8 $\frac{1}{4}$ oz. (687g) with batteries<br>Lens: 6 $\frac{1}{8}$ oz. (174g)                                                                                                                               |                                                   |

that point the battery pictograph will show the half full battery not blinking. Surprisingly, the camera will operate perfectly well and the flash will usually recycle in less than 15 sec. almost down to camera stoppage.

A check of the batteries taken from a camera just ceasing to operate revealed that the batteries still had considerable power—enough to run a flashlight for a while, for instance. Loading them back into the camera after a few minutes' rest revived them sufficiently so they could shoot a few more pictures (a useful emergency measure, perhaps, if fresh batteries aren't available).

When you do have to change batteries, the frame number on the LCD panel will not be lost. The camera contains what Olympus calls a static memory (a writable, electronically erasable ROM of some sort), which needs no battery power but remembers the frame number almost indefinitely—at least until you reload with fresh batteries.

Our advice then is to depend on the Flash Grip 300 for the occasional flash shot where the number of shots won't number more than half the roll. Certainly its Flashmatic operation and use of small apertures for close distances has many uses for nature photographers needing maximum depth of field.

For more consistent flash picture-taking over many rolls, try an F280 or other accessory flash—unless you are prepared for many battery changes. For the snapshotter or tyro, the Grip 300 may be all that will ever be needed.

Despite the comprehensive flash possi-

bilities available with the OM77AF, we were somewhat disturbed that, except for the Flash Grip, all flash shots would be made at the relatively large lens aperture f/4. Especially when using tele lenses and shooting closeup, depth of field would be quite shallow. Was there no way to use lenses at smaller apertures with flash? then it hit us. Put a regular Olympus OM lens on the camera and shoot at aperture-preferred autoexposure! We could then set whatever aperture we wished and the off-the-film TTL flash would provide the proper exposure, complete with flash ready and OK signals in the finder! It works! So for maximum field depth with the F280 or other flash units in low light, switch to a non-AF Olympus Zuiko.

We are certain that a novice or snapshotter would be delighted with the conveniences and abilities of the OM77AF—perhaps more so than with any other autofocus SLR. Whether a serious photographer could operate happily within the confines listed and the rather limited number of lenses available is open to question, but certainly the OM77AF is an ingenious answer to the question: Why can't "they" build an SLR as easy to use as a lens-shutter point-and-shutter camera. "They" can and "they" have. (March 1987)

## 50mm f/1.8 AF FOR OLYMPUS 77AF

**Specifications:** 50mm f/1.8 Olympus AF,



## 35MM Single Lens Reflex

No. 1012163; in Olympus AF OM bayonet mount, accepts 49mm accessories; f/1.8-22 with continuous automatic f/stop settings, no manual f/stop settings except f/4 for flash; infrared focus indicator dot, built-in collapsible lensshade, min. foc. dist.: 18 in. (0.45m); 1-5/16 in. long, 2-1/2 in. diam. (33x63mm); 6-1/8 oz. (174g). Price \$100.

**Practical comments:** No manual focusing ring—auto or power focus only; no aperture scale on lens, aperture appears in finder only; distance and depth-of-field scales nicely visible; lens finished in shiny black with rubberized finger grips on opposing sides of the lens barrel.

**Field test slides:** Transparencies were crisp and snappy overall with well-rendered detail. A slight softness noted in the corners at full aperture was gone by f/2.8. By f/4 corners equalled center in sharpness. Flare was well controlled throughout. Overall, an average to slightly better than average performance for a lens of this type.

**Optical bench analysis** (for optical experts only): On axis, we saw very slight overcorrected spherical aberration with very slight red flare gone by f/4. The diffraction limit was reached by f/8. Off axis, very slight coma could be seen with very slight astigmatism, which diminished by f/11. There was lateral color throughout.

### PERFORMANCE

| Our Standard                                                                | as Tested    |
|-----------------------------------------------------------------------------|--------------|
| Focal length: $\pm 5\%$<br>(47.50-52.50mm)                                  | 51.85mm      |
| Aperture: $\pm 5\%$<br>(f/1.71-1.89)                                        | f/1.83       |
| Distortion:<br>( $\pm 1.5\%$ )                                              | 48% (barrel) |
| Light falloff: at f/5.6<br>+ 1 stop from theoretical limit<br>(0-1.5 stops) | 0.2 stops    |

### RESOLUTION

OLYMPUS AF 50mm f/1.8  
at 1:47

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 1.8 | Good          | 47 V. Good    |
| 2.8 | Accept        | 47 Good       |
| 4   | Accept        | 53 Good       |
| 5.6 | V. Good       | 66 Good       |
| 8   | Excellent     | 75 V. Good    |
| 11  | V. Good       | 59 Excellent  |
| 16  | V. Good       | 59 V. Good    |
| 22  | Accept        | 47 Good       |

### CONTRAST

OLYMPUS AF 50mm f/1.8  
at 30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 1.8 | Medium     | 42 High    |
| 2.8 | High       | 52 High    |
| 4   | Medium     | 55 High    |
| 5.6 | Medium     | 56 High    |
| 8   | Medium     | 52 High    |
| 11  | Medium     | 47 High    |
| 16  | Medium     | 47 High    |
| 22  | Low        | 35 Low     |

## OLYMPUS OM 88: POWER PERFORMER

**SPECIFICATIONS:** Olympus OM88 power-focusing 35mm single-lens reflex camera. Body No. 1029611. **LENS:** 50mm f/2.0 Olympus Lens PF in Olympus bayonet mount. **SHUTTER:** Electronic, vertical-travel metal-blade focal plane with speeds from 2-1/2000

second, plus B (with optional Manual Adaptor 2); X sync at 1/80 second.

**EXPOSURE SYSTEMS:** Program autoexposure, plus aperture-priority AE and manual exposure with Manual Adaptor 2. Silicon photo cell above eyepiece reads center-weighted pattern for manual exposure metering, to control aperture in program mode and to provide camera-shake warning in viewfinder. Second silicon blue cell in mirror box provides center-weighted, off-the-film readings for TTL autofocus, and determines shutter speed in aperture-priority and program modes. EV range 1-20. **FOCUS:** Power focus for Olympus AF and PF lenses. Conventional focus with focusing ring for Olympus OM lenses.

**FLASH:** Three-pin dedicated hot shoe provides TTL flash with automatic off-the-film exposures for Olympus T Series and F280 flash units. Flash sync is set automatically; Full Synchro operation of F280 does not function with OM88. Non-dedicated flash units can only be used with AF lenses when Manual Adaptor 2 is in place.

**VIEWFINDER:** Fixed eye-level prism with fixed Super Lumi Micron Matte screen, including center split-image rangefinder with microprism collar. LED indicators for exposure mode, camera-shake warning, manual-exposure setting, flash ready, correct flash exposure.

**OTHER FEATURES:** Auto DX film speed setting ISO 25-3200 (no manual ISO settings), auto load, auto wind, motorized rewind at end or mid-roll, single-frame advance only, electronic self-timer with LED and beeper, audible warning for incorrect film loading, backlight control adds 1.5 EV exposure, optional Manual Adaptor 2 allows aperture-priority and manual metering, provision for accessory back.

**BATTERIES:** All power supplied by four AAA alkaline cells. **PRICE:** \$385 with 50mm f/2 PF lens.

The Olympus OM88 makes a strong bid to be the perfect bridge camera. Going well beyond the lens/shutter level, it still strives for the sleek, unimposing design that invites point-and-shooters to comfortably and confidently step up to an SLR with its attendant advantages: interchangeable lenses, through-the-lens metering and a wide range of automated features. In keeping with point-and-shoot convenience and styling, the body is compact and well-balanced with all controls falling easily to hand. In order to keep the price attractive (\$385 list, with 50mm f/2 lens), its designers omitted automatic focusing, built-in flash and manual control—the camera provides manual only when you add the optional Manual Adaptor 2 (\$33 list).

The most unusual feature of the OM88 is power focusing, and it's sure to be controversial. Because Olympus AF lenses do not have user-accessible focusing rings, there had to be a way to focus them manually. The previously introduced Olympus OM77AF offers a choice: autofocus or powered manual. On the 77AF, power focus is accomplished by pressing a slider switch on the top right edge of the camera body. You push one

way to focus closer, the other way to focus farther away. Unfortunately, the two-speed power-focus switch on the OM77AF is rather small and stiff, and most users find it easier to use the built-in AF system. But the OM88 does not offer autofocus, so the power focus system has to be good enough for everyday use—and it is. First, it's a big improvement over the OM77AF. The 77AF slide switch has been replaced by a knurled wheel on the 88. The wheel is easily turned by your right thumb—just flick the wheel to the left to move the lens toward infinity; to the right for closer focusing. We found that a quick, forceful spin of the wheel would take the lens from infinity to about two feet (or vice versa) in a fraction of a second. Naturally, more subtle movements are possible—and necessary—the trick is to keep your thumb in a horizontal rather than vertical position, so that more of its surface touches the wheel at any given moment. This allows very fine control of the wheel's movements in both directions. Although this system requires operation by the right hand, we don't think you lefties out there will have any significant problems. All that is required is a back-and-forth motion of the thumb, not complex, coordinated movements.

For all the electronic innovation, Olympus' power focus is really manual focusing with a different kind of wheel. You make focus adjustments the usual way, by looking into the camera's reflex viewfinder. There you'll see a horizontal split-image rangefinder surrounded by a microprism collar, set in the middle of a traditionally bright Olympus focusing screen. The black vertical panel at the left of the screen (and protruding slightly into the picture area) contains several LED exposure indicators—more about their role later.

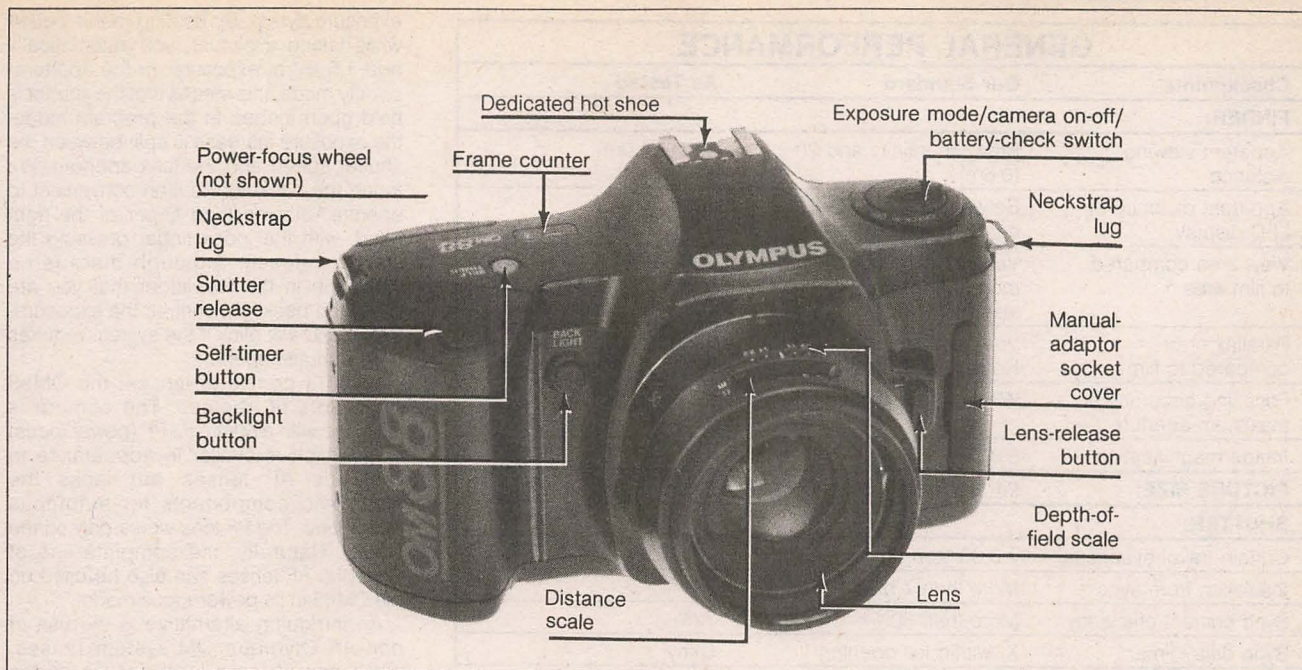
We found that focusing via right thumb on the drive-wheel takes a little practice, but it's quite effective once you get the hang of it. (You may recall that some Fuji rangefinder cameras of the early 1970s had a mechanical focusing wheel in the same place, and, of course, classic Contax rangefinders were usually focused using the right forefinger.)

A significant advantage of the OM88's power-focus system is that it leaves your left hand free. With a zoom lens mounted, this means you can use your left hand to zoom and your right hand to focus, all at the same time and without fouling up either operation. (Your right thumb has leisure time. The 88's built-in winder takes care of film advance.) Yes, it takes a few tries to get everything coordinated, but we found the effort to be well worthwhile.

As you might expect, there's no free lunch and power focus does have a drawback: It makes a distinct whirring sound as you focus, which could prove obtrusive in quiet surroundings.

Before we can take any pictures, we have to load up. Press down on a spring-loaded latch on the side of the camera body and the back pops open (and the frame counter resets to its "S"-for-start position). Next, slide the film cartridge into the well to the left of the shutter. This compartment has two springs to hold the cartridge in position and six contacts to read the DX-encoded film speeds. Pull the film leader over a pair of sprocket wheels





and align its end with a small red mark. Snap the back closed and the OM88 automatically advances film to the first frame. The entire process takes a few seconds, and is just as simple and foolproof as loading a point-and-shoot camera.

A small window on the camera back reveals the type of film you've loaded and the total number of exposures. The film speed—with DX-encoded film—will be set to the manufacturer's ISO settings over a range of ISO 25–3200. Although some photographers prefer to rate film a little higher or lower than the standard ISO setting, Olympus has opted for maximum simplicity in this area. The OM88 instruction manual warns against using non-DX-coded cartridges, which the camera appears to set at ISO 25 rather than the standard default value of ISO 100.

The OM88's frame counter—like most mechanical counters—continues to register frames whether or not film is actually advancing. This caused no problems, however, even when we purposely loaded film incorrectly, because the camera warned us audibly (with a beeping sound) and visibly (a flashing LED) that we had done something wrong.

Film advances by one frame each time the shutter button is pressed; the OM88's built-in winder is not designed for multi-shot bursts. At the end of the roll, you push a small button on the bottom of the camera and the film rewinds all the way into the cartridge.

You turn a small, clearly marked dial on the left side of the top deck to set the exposure mode. When using the OM88 without the Manual Adaptor 2, there is only one exposure mode: Programmed autoexposure (marked "P"); the dial also turns all camera systems off and provides a battery test position. The latter is a spring-loaded setting; you press on it for a moment, causing the camera to beep and the self-timer LED above the lens to light if the four AAA batteries that power the 88 are in good shape. There are two more

positions on the dial ("M" and "A") that become functional only when the manual adaptor is in place.

Before mounting the adaptor, you have to remove a long, narrow rubber cap (called the "contact cover") from the front right side of the camera body. (This inconspicuous cover is very easy to lose, so we stored it in a clearly labeled film canister.) With the cap off, you'll see a row of electrical contacts topped by a small, threaded hole. The adaptor has a matching set of pins and a screw that fits into the hole. Once you have aligned the adaptor with the socket, turn the screw head with a coin to secure the unit in place. Although the adaptor is a cinch to attach and remove, it is so small and lightweight that we just left it in place most of the time. If you're wondering why it's called the Manual Adaptor 2, it's because Olympus provided a different manual adaptor for the earlier OM10 model. Because the adaptor covers the OM88's back-opening latch, it has a lever of its own to do the job.

Naturally, the program mode sets both aperture and shutter speed. This makes it an ideal choice for beginners—or for anyone who likes to shoot quickly in changing light. Also, Olympus has wisely chosen a set of programmed values that promote steady, hand-held picture taking. For example, in the program mode at low light levels, the 50mm f/2 lens is always used at its widest aperture when shutter speeds of 1/60 second or slower are called for. As the light level increases, faster shutter speeds and smaller apertures are chosen. This 1/60 second pivot point is significantly higher than the 1/15 second value used on many exposure programs. (At EV 8 with ISO 100 film, the OM88 program exposes at 1/60 second and f/2, rather than the usual 1/30 second, f/2.8.) The program mode is indicated by an LED in the viewfinder in the shape of a "P." The P glows steadily during normal operation and blinks if a shutter speed of 1/60 second or longer is required.

The vast majority of point-and-shoot cameras use programmed exposure, so it seems quite logical that this be the OM88's standard mode. But with the manual adaptor in place, the camera's exposure-system options become far more versatile than any point-and-shooter. (Programmed exposure can still be used, however, even with the adaptor mounted.) By turning the mode-selector knob on the camera to "Adaptor A" or "Adaptor M," you select the aperture-priority or manual-exposure mode, respectively. In either of these modes, the f/stop is set with a small knurled dial on the manual adaptor. To get the aperture you want, you align the desired f/stop with an appropriate index mark. There are three of these marks, labeled "lens F2," "lens F2.8" and "lens F4." You choose the index that corresponds to the *maximum aperture* of the lens you're using. If none of these settings is exactly right, you use the closest value, such as lens F4 for an f/3.5 zoom.

In the aperture-priority mode, the OM88 automatically chooses a shutter speed from its stepless range of 2–1/2000 second. There is no indication of the exact shutter speed chosen by the camera, but an A-shaped LED in the viewfinder blinks to warn of possible camera shake at speeds of 1/60 second or below. The A shines steadily at higher speeds. The great advantage of aperture-priority automation is that it lets you control depth-of-field by choosing a particular f/stop. Because the OM88 (like many current cameras) does not have a depth-of-field preview control, you have to rely on the d-o-f scale on the lens in use. We found the scale on the 50mm f/2 PF lens to be usable but not ideal, because it only shows the d-o-f (depth-of-field) values for f/11 and f/22. Experienced photographers learn to estimate depth of field, but for beginners a more extensive scale is a great help. (More about this when we talk about the use of OM-system lenses on the 88.)

You'll get the ultimate in exposure control when you use the camera's manual



## GENERAL PERFORMANCE

| Checkpoints                           | Our Standard                                                                                                                                                                        | As Tested                                        |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <b>FINDER:</b>                        |                                                                                                                                                                                     |                                                  |
| Apparent viewing distance             | Between infinity and 20 in. (0.5m)                                                                                                                                                  | 39 in. (1.0m)                                    |
| Apparent distance of LED display      | Between 79 in. (2.0m) and 26 in. 39 (0.7m)                                                                                                                                          | 39 in. (1.0m)                                    |
| View area compared to film area       | Vertically and horizontally more than 90%, less than 100%                                                                                                                           | Vertical: 93%<br>Horizontal: 93%                 |
| Parallax error compared to film       | Vertical: 0.8mm<br>Horizontal: 1.3mm                                                                                                                                                | Vertical: 0.2mm (up)<br>Horizontal: 0.4mm (left) |
| Focusing accuracy at maximum aperture | Within depth of focus                                                                                                                                                               | No Discrepancy                                   |
| Image magnification                   | 0.80X $\pm$ .1X                                                                                                                                                                     | 0.81X                                            |
| <b>PICTURE SIZE:</b>                  | 24 $\pm$ 0.6mm x 36 $\pm$ 0.9mm                                                                                                                                                     | 23.9mm x 36.1mm                                  |
| <b>SHUTTER:</b>                       |                                                                                                                                                                                     |                                                  |
| Curtain travel evenness               | $\pm$ 0.33 stop                                                                                                                                                                     | -0.2 stop                                        |
| Insulation from sync                  | More than 7 megohms                                                                                                                                                                 | Infinity                                         |
| Sync contact efficiency               | More than 60%                                                                                                                                                                       | 72%                                              |
| Sync delay time                       | X: within full opening                                                                                                                                                              | Okay                                             |
| Shutter curtain bounce                | Not allowed                                                                                                                                                                         | None                                             |
| Self timer delay                      | 7-15 seconds                                                                                                                                                                        | 12 seconds                                       |
| <b>CAMERA NOISE:</b>                  | 75 dB(a), average for a motorized SLR                                                                                                                                               |                                                  |
| <b>CAMERA SIZE:</b>                   | Body: 5 $\frac{3}{4}$ in. wide x 3 $\frac{3}{16}$ in. high x 2 $\frac{3}{8}$ in. deep (148 x 90 x 61mm)<br>Lens: 1 $\frac{1}{2}$ in. long, 2 $\frac{1}{2}$ in. diameter (36 x 64mm) |                                                  |
| <b>WEIGHT:</b>                        | Body: 1 lb. 5 $\frac{3}{8}$ oz. (606g) with batteries<br>Lens: 5 $\frac{1}{4}$ oz. (149g)                                                                                           |                                                  |

mode. As mentioned earlier, this makes use of the knurled aperture dial on the manual adaptor. Turn a similar dial near the bottom of the adaptor to choose the shutter speed, also from a range of 2-1/2000 second, plus B and X (for flash sync with non-dedicated units). The two wheels are easily adjusted by your left thumb, with either eye to the viewfinder. With the camera in the manual mode, a pair of LED arrowheads ( ) appear in the data display on the left side of the finder image. The upper arrow indicates overexposure, the lower underexposure. When exposure is correct (within a tolerance of plus/minus 0.5 EV) both arrowheads light up. When either arrow alone is lighted, your exposure is between 0.5 EV and 1.5 EV off in the direction indicated. Errors greater than 1.5 EV are signaled by a blinking arrowhead.

We found the manual mode very useful in some unusual shooting situations, particularly with narrow-latitude slide films. For instance, if you want extra-saturated colors, it's easy to dial in 1/2 stop of underexposure by turning the f/stop wheel until the lower arrowhead just lights. A pleasantly high-key effect can be obtained by dialing in a similar amount of overexposure. And for shooting fast-moving subjects, you can preset the shutter speed to a high value such as 1/2000 second and use the f/stop wheel to adjust exposure. This method works best in consistent lighting conditions; it's difficult to adjust the aperture fast enough to compensate for a race car speeding from sunlight to shade and back again. But that's what the autoexposure mode is for.

The OM88 actually contains two

separate light-metering systems working in tandem. Both of them "read" light entering through the lens in a center-weighted pattern. The more conventional of these systems uses one silicon blue photocell located in the pentaprism housing to measure light hitting the focusing screen. The cell is switched on by slight pressure on the shutter-release button, and it automatically turns off after about 30 seconds unless the shutter button is tapped again. This system provides accurate, continuous light measurement for manual-exposure control, and for low-light warnings in the aperture-priority and program autoexposure modes. In addition, it sets the f/stop when the camera is in the program mode.

More sophisticated readings are taken by a second cell located in a cutout on the left side of the mirror box, within the camera body. This cell faces backward, and it reads the light falling on the shutter curtain and/or the film itself during the exposure in the aperture-priority or program modes. When enough light has been detected, this system signals the automatic shutter. As we'll see, the cell also plays a role in flash photography. If the main job of the focusing-screen-reading cell is to provide guidance and information for the photographer, this off-the-film (OTF) reading cell actually makes most of the final decisions. And in those rare cases when the light changes drastically *during* the actual exposure, OTF metering may save the picture.

You can use a small button on the front panel, right next to the handgrip, to compensate for strongly backlit scenes that might otherwise fool the

exposure system. By holding in this button while taking a picture, you automatically add 1.5 EV of exposure. In the aperture-priority mode, this means that the shutter is held open longer; in the program mode, the exposure increase is split between the shutter speed and the lens aperture. We found the back-light button convenient to operate with the third finger of the right hand, with the index finger pressing the shutter release. Although there is no indication in the viewfinder that you are using the backlight control, the exposure-mode LED will blink if the system requires a slow shutter speed.

When it comes to lenses, the OM88 offers lots of choices. The camera is supplied with a 50mm f/2 PF (power focus) lens, which is similar in appearance to Olympus AF lenses but lacks the electronic components for autofocus operations. The PF lens works *only* on the OM88. Naturally, the complete line of Olympus AF lenses can also be used on the OM88 in its power-focus mode.

An intriguing alternative is the use of *non-AF* Olympus OM-system lenses. When one of these lenses (such as the compact 35mm f/2.8 that we tried) is mounted on the OM88, the camera automatically switches to aperture-priority automation. This mode is chosen even if the manual adaptor is not in place. With the adaptor, manual exposure can also be selected. Two important differences: the viewfinder data display and the power-focus system do not function with OM-system lenses. Of course, these lenses have their own focusing rings, so distance setting is no problem. In addition, many OM-system lenses have built-in depth-of-field preview buttons. These remain operational on the OM88, providing better d-o-f control than is possible with the newer AF lenses! Just keep in mind that to remove an OM-system lens from the OM88, you have to use the release button on the lens, *not* the one on the front of the camera body.

Another thoughtful feature is a sturdy tripod socket, located on the bottom of the camera right on the lens axis. A metal cap at the top of the socket prevents extra-long tripod screws from damaging the camera's interior, and a grooved area around the socket provides extra grip for the tripod head. Because of the power-focus system, tripod heads of any size can be accommodated without getting in the way of a lens-focusing ring.

A blue button on the OM88's top deck controls the self timer. To start the timer, hold in the button while pressing the shutter release. A beeper starts sounding and an LED flashes on the front panel. After ten seconds the beeper shifts upward in pitch to warn that exposure is imminent, and two seconds later the picture is taken. At any time during this 12-second cycle, you can disarm the timer by pressing the blue button.

We've mentioned the viewfinder data display in connection with each of the available-light exposure modes. It also provides information when a dedicated Olympus T-series or F-280 flash is being used. (The compact Olympus T18 flash [\$59 list] seems like an appropriate companion for the OM88, so we chose it for our tests.) The first step is to slide the

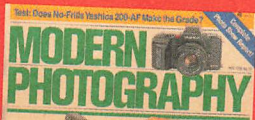
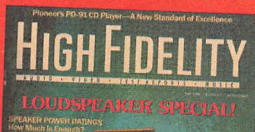


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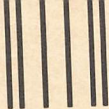
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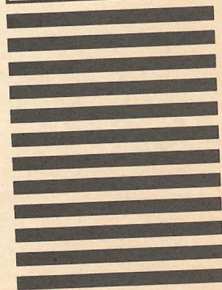
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flash into the camera's hot shoe and turn it on. A few seconds later, when the charge light on the back of the flash glows, a lightning-bolt LED symbol in the OM88 viewfinder signals that the flash is ready. With the camera in its program mode, the flash-sync speed and an appropriate lens aperture are chosen automatically. After each flash picture, the lightning bolt symbol blinks to let you know the exposure was right.

But this easy-to-use flash system is far more sophisticated than it appears. For example, if the ambient light is bright enough to allow a shutter speed of 1/60 second or higher, the flash does not fire even if it's switched on. This provision saves battery power for those situations when the flash is really needed. If the available light is low enough to require flash, the synch speed of 1/80 second is set automatically, along with an aperture one stop smaller than the lens's maximum setting. As the flash fires, the OTF sensor in the OM88 body reads light reflected from the film surface, and quenches the flash when proper exposure has been achieved. Once again, this conserves battery power, while maximizing flash range as much as possible without using the lens wide open.

After an extended period of working with the OM88, we found its most striking attribute to be simplicity of operation. Controls are few in number, clearly marked and conveniently placed; the camera handles well with lenses of various sizes. Even novice photographers who have only used point-and-shoot cameras will soon find the OM88 to be a natural extension of their hands. True, the 88 lacks a built-in flash, but the T18 is small and light enough to become virtually a part of the camera, and it is more powerful than the typical built-in flash unit. More advanced photographers will certainly want to add the Manual Adaptor 2, which increases the versatility of the OM88.

As we said earlier, power focusing is sure to be a point of consideration for potential users of the OM88. We think that many photographers will come to like this feature if they approach it with an open mind and take a little time to familiarize themselves with it. PF is not meant to be a substitute for AF, but it is certainly a viable system that has its own distinct virtues. Come to think of it, that is an accurate, though brief, description of the OM88 camera as well!

## OLYMPUS PF 50mm F/2.0 LENS

**Specifications:** 50mm f/2.0 Olympus Lens PF No. 114351 in Olympus bayonet mount; accepts 49mm accessories; f/2-22 settable in half stops with Manual Adaptor 2; minimum focal distance: 18 inches (0.45m); \$85.

**Comments:** Focuses by power-focus wheel only, which is easily controlled by user's right thumb. Slight motor noise when focusing. Lens operates on OM88 only. No external aperture or focus settings. Focusing distance visible

through cutout on mount. Has depth-of-field markings for f/11 and f/22, infrared focus mark. Dull black finish. Has two recessed finger-hold areas to facilitate lens mounting and removal.

**Field test slides:** Overall, slides were crisp and snappy with detail well rendered. Corners were slightly soft at f/2, improved by stopping down to f/2.8. Corners equalled center sharpness by f/4. Very slight light falloff wide open was gone by f/2.8. Has minimal barrel distortion. Flare well controlled throughout aperture range. Overall, an average performance for a normal lens.

**Optical bench analysis:** On axis, very slight overcorrected spherical aberration, Red/yellow flare gone by f/4. Diffraction limit reached by f/16. Off axis, very slight astigmatism mixed with very slight coma, both almost gone by f/16. Lateral color present.

For many years many camera manufacturers have been eyeing what they consider a vast, untapped market—the photographer who wants to know little about photography and who wants to apply this lack of knowledge to the wondrous workings of the 35mm camera.

## PENTAX A3000: MODERATE PRICED MULTI-MODE SLR WITH DX CODING, AUTO WIND

**MANUFACTURER'S SPECIFICATIONS:** Pentax A3000 35mm single-lens reflex camera. Body No. 3012186. LENS: 50mm f/1.7 SMC Pentax-A in KA mount focal plane. SHUTTER: Seiko MFG E6 vertical travel multi-blade with electronically controlled speeds from 2 to 1/1000 sec., 1/60 sec. and B mechanical settings, 1/60 sec. flash sync. EXPOSURE SYSTEMS: Program, aperture priority AE, program auto flash, GPD (gallium photo diode) cell atop eyepiece in finder reads centerweighted area of focusing screen; EV1-18 (at ISO/ASA 100); Auto DX and manual film speed setting, ISO/ASA 25-1600; +1.5 EV exposure-compensation button. FLASH: Dedicated hot shoe non-TTL with sync speed and aperture set in program auto flash mode, speed only set in aperture-priority exposure mode. VIEWFINDER: Non-interchangeable eye-level prism with horizontal split-image rangefinder, micropism collar, full-area focusing non-interchangeable screen; P mode, green 60 to 1000, yellow 30 LED alphabetical and numeral indicators, flash ready and OK signals, out of exposure range, slow shutter speed and speed setting error warnings. OTHER FEATURES: Auto film loading, power wind to 1.5 fps, auto advance to first frame, film end warning LED, rear film reminder window, shutter lock, electronic 12 sec. cancelable self-timer with

## 35MM Single Lens Reflex

blinking and audible warnings, audible overexposure warning; built-in handgrip, battery check LED. BATTERIES: Two AA alkaline energizers. PRICE: Body: \$263, with 50mm f/1.7 lens, \$368.

Having first carefully catered to the serious SLR aficionado with the Pentax LX, Super Program and Program Plus, after providing the middle ground ME Super, Asahi is now apparently taking a positive step towards the SLR beginner. But is the A3000 just a beginner's camera?

From the moment you lay eyes on the A3000 or grasp it in your hands, you'll know it is some other kind of a Pentax. The longish shape is due primarily to the nicely contoured two AA cell battery holder and grip which allows the camera to be wielded easily with one hand alone. The outer skin of the polycarbonate body makes no pretense to artificial leather finish but instead offers a dullish, smooth attractive finish. The grip however is covered in a softer rubberish material for added grasping security. A clever forward tilt of the red-circled, ample sized, 7/16 in. diameter magnetic shutter release button brings the button right under your forefinger. With the addition of the ribbed rear right grip, it seems highly unlikely that any but the most fumble fingered could possibly let the camera slip to the ground accidentally. The right hand grips, activates and controls the camera while the left neatly supports it from underneath and allows focusing quite conveniently when you grasp the heavily knurled focusing ring between your left thumb and forefinger. Ergometrically then the camera is a resounding success.

Upon opening the camera back in the customary pull-up-on-the-rewind knob style, several shocks await you. The entire interior of the camera focal plane appears to be of the same polycarbonate material as the rest of the body. It is. The similarity in form and shape to Canon's T50 SLR introduced in 1983 is remarkable.

Within the film chamber you'll see six pairs of gold-plated electrical contacts. These are the camera's DX code pins, sensing the ISO/ASA index of the film from the clear metal and painted cartridge patchwork exterior and automatically keying it, from 25 to 1600, into the camera exposure system. Pairs of contacts rather than single ones provide insurance against improper settings.

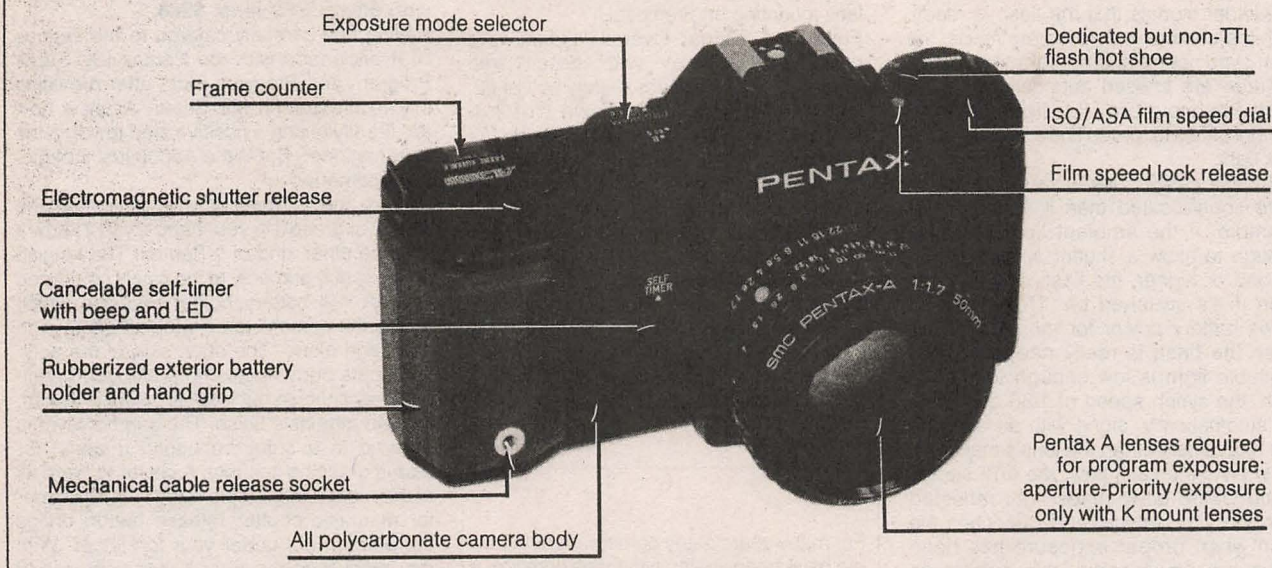
To the right of the camera's sprocket wheel is an automatic film loading takeup spool and longish red marker indicating where you should place the film leader. After doing so, just shut the camera and press the shutter release. The shutter will fire at 1/1000 sec. and the film will be advanced automatically to the first frame. The motor will then stop and you'll be ready for your first picture.

The frame counter is labeled "frame advance" most clearly. Almost all controls on the camera are marked with remarkable clarity. Each time a picture is taken and film is advanced (up to speeds of 1.5 frames per sec. if you keep your finger on the shutter release), a red LED signal blinks just behind the frame advance window. Presumably, it indicates that the camera is properly loaded and film is advancing correctly but it's also useful as a battery check.

There is no film box reminder slot on the back of the camera since the back has a cartridge identification window through which you can identify most film makes (and more as additional film makers adopt DX coding for



## What's New At A Glance: Pentax A3000



all films plus standardized cartridge exterior film information). However many film cartridges do not provide information through the window as of now.

The well knurled outer ring of the rewind knob contains a manually setting ISO/ASA indexing scale in case your film does not have DX auto indexing coding. The 100 marking is used for auto DX operation.

You'll find a heavily click stopped mode selector control with easy to grasp operating lever located just to the left of the prism housing. Markings in green offer program exposure, with the camera selecting both shutter speed and aperture, a shutter lock, battery check (the red LED behind the frame camera lights if batteries are good), a 60 ( $\frac{1}{60}$  sec.) mechanical shutter speed which can also be used for flash and a mechanical bulb setting for long exposures. (You might well wonder why an all electric advance camera should bother at all with a mechanical  $\frac{1}{60}$  sec. shutter speed, but it is required if you should wish to use the camera with a non-dedicated electronic flash unit which does not automatically set the camera to the right sync speed).

What, only program exposure control? No. The camera can be set for aperture-priority auto exposure by keeping the mode selector switched to program but by releasing the lens aperture ring with the release button so it can be turned to whatever lens opening you wish instead of remaining at the "A" setting. The camera will then select the proper-exposure shutter speed.

Exposure information within the viewfinder appears on a black vertical panel which impinges slightly on the left side of the focusing screen. Information has been kept to a minimum so as to give the tyro a sufficiently comprehensive yet simple to understand method of operating the camera. LED shutter speeds set by the metering system from 60 to 1000 are in green indicating that they can be hand-held. The 30 is in yellow as a warning. Should speeds fall below, from 30 to 2 sec., the 30 will blink slowly. If the needed exposure is out of the exposure system's range, the 30 will blink rapidly. At the other end of the scale, in

extremely bright light, should exposure be beyond the camera's range, the 1000 will blink rapidly. Additionally, an audible beeping can be heard as a warning in case the light is too bright to see the 1000 warning blink.

A bright green "P" lights when the camera is set for full program exposure. The P blinks rapidly if the mode selector is set to B or the mechanical  $\frac{1}{60}$  sec. speed (there is no other B or 60 mechanical signal in the finder). The P also lights as a viewfinder battery O.K. signal when the mode selector is used for checking battery health.

The entire focusing screen and finder information can be seen by eyeglass wearers.

The A3000 uses the relatively new Pentax KA lens mount with its electrical contact system which provides the camera body with the proper information for program exposure and accurate finder information. Should you use older regular K mount Pentax lenses, you can operate the A3000 only in aperture-priority auto exposure (or 60 and B).

If the 30 shutter speed warning signal starts to blink it's necessary to operate the camera on a tripod with a cable release (yes, there is a mechanical cable release socket) or use flash.

The A3000 does have a comprehensive hot shoe flash sync system but does not offer through-lens, off-the-film auto flash exposure control as do the Pentax Super Program and Pentax Plus. When the Pentax AF200T, AF280T or AF400T flash units are used on the A3000 in program mode, the unit will automatically set the proper  $\frac{1}{60}$  sec. shutter sync. speed as well as the aperture as selected by setting the color-coded aperture indicator on the flash unit. The flash unit setting as well as the flash unit model determines the flash range. If you elect to use aperture-priority auto exposure, the shutter speed will be set for you but not the aperture.

While this system is far more limiting than the TTL autoflash measuring system on the Super Program and Program Plus which allow you to set any aperture and vary your flash range, the limited two or three possible apertures of the A3000 direct flash measuring system should be sufficient for most amateurs. When the flash is fully recycled a

lightning flash signal is seen in the viewfinder. The signal blinks following exposure if the illumination was enough.

In actual shooting, the A3000 operated swiftly and conveniently. With fresh batteries we timed its top sequence operational speed at 1.49 frames per second, certainly close enough to live up to its claimed 1.5 fps. We were curious as to how many rolls of film a fresh set of batteries could drive through the camera before they had to be replaced. The directions were confusing. In one place they stated 10 and in another 50, quite a disparity. In field tests we bettered 50 rolls of 36 exposures on one set of batteries so we know which part of the directions are wrong.

We found the split image rangefinder and microprism collar worked crisply with lenses having apertures of  $f/5.6$  or greater. With smaller maximum openings, we'd advise using the outer full focusing area. Finder brightness was good but about a half stop less than the top of the line Super Program. The aperture LEDs were bright and easy to see. Since the  $\frac{1}{30}$  sec. LED blinks as soon as light falls below the level for a  $\frac{1}{60}$  sec. exposure, we were not able to determine actual speeds below  $\frac{1}{60}$  sec. A blinking yellow 30 could be  $\frac{1}{30}$  sec. or perhaps a much slower speed. Still, resorting to a tripod or other support if exposures demand a lower speed than  $\frac{1}{60}$  sec. will probably yield sharper pictures generally.

We missed being able to see the programmed aperture settings in the finder but these are seldom available except in the most expensive top of the line SLR cameras. There is no depth-of-field control nor is there a PC terminal. You must run your flash off the prism-mounted hot shoe.

On the definite plus side was the ruggedness and solidity of the plastic body and controls although the undisguised plastic construction did unnerve us at first. (Is it better to have camera parts appear to be metal as others do or boldly flaunt their plasticity? It's a personal choice.) However we could not fault the accuracy of the all plastic body precision in terms of film-lens accuracy. The smooth electromagnetic shutter release, the very legible frame counter



## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                                                                            | As Tested                                         |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                                                                         |                                                   |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                                      | 39 in. (1.0m)                                     |
| Apparent distance of shutter-speed scale | Between 79 in. (2.0m) and 36 in. (0.66m)                                                                                                                                | 32 in. (0.83m)                                    |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                                                               | Vertical: 93%<br>Horizontal: 92%                  |
| Parallax error compared to film          | Vertical: 0.9mm<br>Horizontal: 1.4mm                                                                                                                                    | Vertical: 0.7mm (up)<br>Horizontal: 0.2mm (right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                                   | No Discrepancy                                    |
| Image magnification                      | 0.82X $\pm$ 1X                                                                                                                                                          | 0.90X                                             |
| <b>PICTURE SIZE:</b>                     | 24 $\pm$ 0.6mm X 36 $\pm$ .09mm                                                                                                                                         | 24.2mm X 36.2mm                                   |
| <b>SHUTTER:</b>                          |                                                                                                                                                                         |                                                   |
| Curtain travel evenness                  | $\pm$ 0.33 stop                                                                                                                                                         | 0.16 stop                                         |
| Insulation from sync                     | More than 7 megohms                                                                                                                                                     | Infinity                                          |
| Sync contact efficiency                  | More than 60%                                                                                                                                                           | 85% (hot shoe)                                    |
| Sync delay time                          | X: within full opening                                                                                                                                                  | Okay                                              |
| Shutter curtain bounce                   | No allowed                                                                                                                                                              | None                                              |
| Self timer delay                         | 7-15 sec.                                                                                                                                                               | 12 seconds                                        |
| <b>CAMERA SIZE:</b>                      | Body: 4 $\frac{15}{16}$ in. wide X 3 $\frac{7}{16}$ in. high X 2 in. deep (152 X 88 X 52mm)<br>Lens: 1 $\frac{1}{4}$ in. long, 2 $\frac{3}{8}$ in. diameter (32 X 61mm) |                                                   |
| <b>WEIGHT:</b>                           | Body: 1 lb. 4 $\frac{3}{16}$ oz. (573g) with batteries<br>Lens: 5 $\frac{3}{4}$ oz. (164g)                                                                              |                                                   |

which counts down during rewind thus allowing a measure of multiple exposures even though exact image imposition would not be possible, rated plus points. Good marks should go also to the auto turn off switch that prevents the motor or camera itself from running on when the last frame on a roll has been exposed.

The self-timer provides, on the front of the body, a very bright LED which blinks for the first 10 sec. followed by 2 sec. of faster flashing as a warning to the subjects before the shutter is released. You can cancel it at any time before exposure.

The meter coupling range of the A3000 is adequate, greater than that found in some other more expensive SLRs. While an ISO/ASA 100 film will cover a range of shutter speeds from 1 sec. to the top  $\frac{1}{1000}$  sec., an ASA 400 film proved capable of reaching down to  $\frac{1}{8}$  sec. at the low end and to  $\frac{1}{1000}$  sec. at the top.

We can recommend the A3000 as a very serviceable camera for beginners who wish program exposure and convenience. More advanced photographers may be put off by the lack of control over slower auto exposure speeds than  $\frac{1}{60}$  sec., the lack of manual speeds, manual metering or a method of "holding" an exposure reading and then recomposing the picture (sometimes called a memory lock). In terms of picture taking ability and convenience, however, the A3000 is every bit as good a picture taker as cameras costing many times as much. (May 1985)

## PERFORMANCE

| Standard                                                                          | as Tested |
|-----------------------------------------------------------------------------------|-----------|
| <b>Focal length:</b> +5%<br>(47.50b 52/50mm)                                      | 52.31mm   |
| <b>Aperture:</b> +5%<br>(f/1.52b1.78)                                             | f/1.75    |
| <b>Distortion:</b><br>(q1.5%)                                                     | under 1%  |
| <b>Light falloff:</b> at f/5.6<br>a1 stop from theoretical limit<br>(0b1.5 stops) | 0.4 stops |

## RESOLUTION

| PENTAX-A 50mm f/1.7<br>at 1:51 |                  |                  |           |    |
|--------------------------------|------------------|------------------|-----------|----|
| f/                             | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 1.7                            | V. Good          | 51               | Excellent | 45 |
| 2.8                            | Excellent        | 64               | Excellent | 57 |
| 4                              | V. Good          | 64               | Excellent | 57 |
| 5.6                            | Excellent        | 72               | Excellent | 64 |
| 8                              | Excellent        | 72               | Excellent | 64 |
| 11                             | Excellent        | 72               | Excellent | 64 |
| 16                             | Excellent        | 64               | Excellent | 57 |
| 22                             | V. Good          | 57               | Excellent | 51 |

## CONTRAST

| PENTAX-A 50mm f/1.7<br>at 30 lines/mm |               |               |        |    |
|---------------------------------------|---------------|---------------|--------|----|
| f/                                    | Center<br>(%) | Corner<br>(%) |        |    |
| 1.7                                   | High          | 50            | Medium | 30 |
| 2.8                                   | High          | 68            | High   | 42 |
| 4                                     | High          | 69            | High   | 52 |
| 5.6                                   | High          | 72            | High   | 56 |
| 8                                     | High          | 70            | High   | 54 |
| 11                                    | High          | 66            | High   | 50 |
| 16                                    | High          | 52            | High   | 40 |
| 22                                    | Medium        | 42            | Low    | 30 |

## PENTAX-A 50mm F/1.7

**Specifications:** 50mm f/1.7 Pentax-A, No. 1382340 in KA mount; accepts 49mm filters; f/1.7-22 plus "A"; detents at  $\frac{1}{2}$ -stop intervals thereafter; min. foc. dist.: 18 in. (0.45m); **Price:** \$105.00

**Practical Comments:** Optically identical to previous K-mount 50mm f/1.7, Pentax-A lens has electrical contacts for programmed automation and/or finder readouts on Pentax Super Program A-3000. Lens is average in weight but very compact for 50mm normal.

**Field test slides:** Overall, slides from the 50mm f/1.7 Pentax-A lens were crisp and snappy with detail well rendered. Slight softness was noticeable at full aperture from center to corner. Sharpness greatly increased two stops down and continued throughout the rest of the aperture range which exhibited high sharpness quality from center to corners. Some light falloff was noticeable at f/1.7 but was gone by f/2. Flare was well controlled throughout all apertures. Overall, a slightly better than average lens of its type.

**Optical bench analysis** (for optical experts only): On axis, very slight over-corrected spherical aberration and very slight red flare could be seen, but was gone by f/4. The diffraction limit was reached by f/8. Off axis, there was very slight astigmatism and slight skew ray flare. Lateral color was present.

## PENTAX K 1000: BASIC BODY STILL ENDURES

**MANUFACTURER'S SPECIFICATIONS:** Pentax K 1000 35mm single-lens reflex camera. Body No. 7119204. **LENS:** 50mm f/2 SMC Pentax-M in Pentax bayonet mount, No. 4898911, with stops to f/22, focusing to 1 ft. 6 in. (0.45 m), accepts 49mm screw-in accessories. **SHUTTER:** Rubberized cloth focal-plane with speeds from 1 to 1/1000 sec., plus B, X sync. **VIEWING:** Non-interchangeable eye-level prism with central micropism, fine focusing collar, full focusing screen. **METERING:** Silver-oxide battery-powered CdS cells on either side of viewfinder eyepiece measure entire focusing screen at full aperture. **OTHER FEATURES:** Shutter-wind indicator, hot sync shoe. **MANUFACTURER:** Asahi Optical Co., Tokyo, Japan. **IMPORTER:** Pentax Corp., Englewood, CO 80110. **PRICE:** \$255.

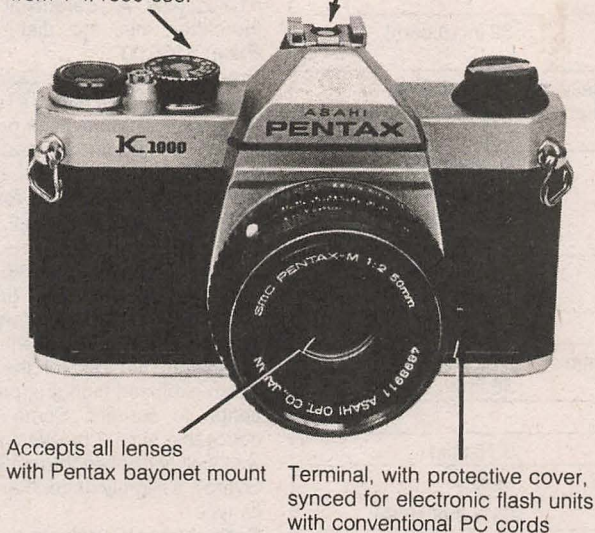
Some things just don't know when to quit. Take the Pentax K 1000 for instance—a basic, simple, manual SLR unfazed by the great upswing in camera technology swirling about it. In an era in which tiny electronic marvels perform just about any picture-taking chore demanded by the average photographer, this all-mechanical model that requires thought and action by the photographer simply goes on and on. No matter how much more automatic and electronic cameras become, there will always be a special place for such a basic camera as this, with all the basic controls. Add to these special qualities a modest price tag and you have, in the K 1000, a camera that is useful as a learning tool for the beginner or student, or as a "second" or back-up camera for the advanced amateur or professional.



## Pentax K 1000: Features At A Glance

Shutter-speed dial provides manually set, mechanical speeds from 1-1/1000 sec.

Hot shoe synced for direct contact with electronic flash units



## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                                                                                                                                                             | As Tested                                            |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                                                                                                                                                          |                                                      |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                                                                                                                       | 52 in (1.3 m)                                        |
| Apparent distance of shutter-speed scale | Between 157 in (4.0 m) and 31.5 in (0.8 m)                                                                                                                                                                                                               | 19.7 in (5.0 m)                                      |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                                                                                                                                                | Vertical: 90%<br>Horizontal: 91%                     |
| Parallax error compared to film          | Vertical: 1.21 mm<br>Horizontal: 2.01 mm                                                                                                                                                                                                                 | Vertical: 0.10 mm (up)<br>Horizontal: 0.05mm (Right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                                                                                                                    | No Discrepancy                                       |
| Image magnification                      | 0.88X± 0.1X                                                                                                                                                                                                                                              | 0.91X                                                |
| <b>PICTURE SIZE:</b>                     | 24± 0.6mm<br>36± 0.9mm                                                                                                                                                                                                                                   | 24.2 x 36.5mm                                        |
| <b>SHUTTER:</b>                          |                                                                                                                                                                                                                                                          |                                                      |
| Curtain travel evenness                  | ±0.33 stop                                                                                                                                                                                                                                               | −0.05 stops                                          |
| Camera insulation from sync              | More than 7 megohms                                                                                                                                                                                                                                      | Infinity                                             |
| Sync contact efficiency                  | More than 60%                                                                                                                                                                                                                                            | 84% Hot Shoe 90% (PC)                                |
| Synchronizer delay time                  | X:within full opening                                                                                                                                                                                                                                    | Okay                                                 |
| Shutter curtain bounce                   | Not allowed                                                                                                                                                                                                                                              | None                                                 |
| <b>CAMERA SIZE:</b>                      | Body: 5 <sup>5</sup> / <sub>16</sub> in. wide x 3 <sup>5</sup> / <sub>16</sub> in. high x 2 <sup>5</sup> / <sub>16</sub> in. deep (141 x 92 x 54 mm); lens: 1 <sup>5</sup> / <sub>16</sub> in. deep x 2 <sup>1</sup> / <sub>4</sub> in. dia. (30 x 57mm) |                                                      |
| <b>WEIGHT:</b>                           | Body 1 lb., 8 <sup>1</sup> / <sub>16</sub> oz. (with battery) (700g); lens 5 <sup>3</sup> / <sub>4</sub> oz. (164g)                                                                                                                                      |                                                      |

The K 1000 is the last of the K series, which was the first to offer the now famous "Pentax K bayonet" mount in what are now regarded as medium-sized bodies. Before the K series, Pentax employed the tried and true, old warhorse M42 universal thread mount so successfully that it's still often, but

incorrectly, referred to as the Pentax screw thread mount. And as the Pentax bayonet mount has gained popularity with other SLR makers such as Ricoh and Chinon, just as the M42 did a generation ago, the K series has been phased out in favor of the M series—even more compact, more electron-

ic and more automatic.

The sole surviving model, the K 1000, is a semi-automatic, match-needle, through-lens metering 35mm SLR. At 5<sup>1</sup>/<sub>2</sub> × 3<sup>1</sup>/<sub>2</sub> × 1<sup>1</sup>/<sub>8</sub> in. deep (without lens) and 20 oz. (less lens) it falls in between the older (thread mount) heavyweights and the newer compact M models. In terms of features and performance, however, it is definitely a classic, save for two minor deviations. First, this "semi-compact" uses the new, truly compact lenses that are the hallmark of the bayonet system and, second, as a thin label strip along the bottom announces, this "body (is) assembled in Hong Kong." While parts of the body are also made on that island, the lens is still fashioned by Asahi Optical in Japan. You can't distinguish this body from the original Japanese product by touch or by sight and we were unable to note any differences either.

Aside from the glorious feeling of self-satisfaction the more advanced photographer might get from operating a camera with total manual control, many of our staff found that the medium bulk and size of the K 1000 works to its advantage, especially for those with larger-than-average hands and fingers. This Pentax sits nicely and balances comfortably in the user's hands and its relatively clutter-free (from controls) body makes for rapid and simple operation. As we've said above, simplicity is the hallmark of the K 1000, which will become more evident as we go through the operation of the camera step by step.

It takes just one SR44 (or equivalent) button-type battery to run the 1000's meter system, and that battery fits neatly into its compartment on the camera bottom. A deep slot on the compartment cap simplifies its removal and a large "+" on the inside provides a definite indication as to proper polarity. Next step, setting the film speed, is accomplished in the tried and true manner by raising the knurled collar around the shutter-speed dial and turning it until the desired ASA number appears in the small window on the dial top. And that's all the preliminary preparation you need.

The K 1000 does not have a battery check per se. Rather, you just have to see whether the match needle system in the finder is working—that is, if the needle moves when you aim the camera at areas of differing light levels, or when you change aperture or shutter speeds. Nor is there an on-off switch, which means there is a small-but-constant drain on the battery which increases when the lens is uncovered. That drain, however, is so small that we found no appreciable loss of battery life during the course of normal camera operations.

Film loading, likewise, is also a quick and easy task. You just pull up on the rewind crank to open the swing-away back, revealing a smoothly finished interior and a rubberized cloth focal-plane shutter. Insert the film leader into one of four slots on the take-up spool and start winding. The spool moves clockwise, that is to say inwardly, making for a positive grip on the film. In addition, the spool's bottom flange is knurled, allowing you to move it in either direction to take up or increase slack in the spool's grip.

As you might expect, the view through this camera's finder is the utmost in simplicity and clarity, and you can see almost the entire field if you are wearing glasses. Focusing aids are a bright, small microprism and a wide fine-focusing collar in the center, both



surrounded by a fine Fresnel screen which also provides a relatively efficient focusing area. We might have wished for a central split-image rangefinder and micropism collar combination, as is found in most modern SLRs, for greater effectiveness on subjects with straight lines, but the 1000's system is better for longer and/or moderate aperture lenses as there's no split-image blackout. So this particular compromise is still with us, with the 1000 opting for the solution that is not in vogue on more current models.

The rest of the viewfinder is bare except for a black band running vertically along the right edge. In the center of this bar you'll find a cutout bracket type area in the form of the right half of the letter "H" with a "+" sign on top and a "-" on bottom. A needle floats over this entire bracket area. To get a proper exposure setting you have to align the needle with the center of this bracket.

The accepted, and easiest, method for matching is to select a shutter speed first and adjust the lens aperture to move the needle, but you can do it the other way if you want to use a particular aperture. It's helpful, but not necessary, to know that you are stopping down your lens (giving less exposure) when the needle is moving toward the "-" end of the scale. The entire system is large and legible enough for easy checking, and the contrast between the black needle and white bracket makes it reasonably easy to see in low light conditions. A final fillip to the match-needle procedure comes from the rather wide "entry" portion of the bracket which is thus broad enough to accommodate three settings—in other words, a range of 1-1½ f/stops which allows you to trim your exposure setting for precise or special effects without shifting the camera from your eye.

Two other minor touches stemming from the "old-fashioned" nature of this SLR actually simplify and speed up normal shooting procedures. Freed from all electronic entanglements and coupling requirements, the focal-plane shutter can be advanced with one long or several short strokes of its ratcheted wind lever. Even with the former, a throw of just 180° is all that's needed to advance film and cock shutter. And when fully cocked, the lever stands about ¼ in. off from the back of the body, allowing you to keep your thumb in position to advance it quickly after you trip the shutter. The other minor point is strictly a Pentax innovation—the shutter-cocking indication in the form of a red dot signal right next to the shutter-release button.

The last-mentioned button is the one control that might be considered the least effective on the K 1000, as it is rather small and in close proximity to both the shutter-speed dial and the frame counter window. However, it is fairly high and thus presents an easily accessible contact point for all but the clumsiest of trigger fingers. In addition, there is only one releasing action—you don't have to touch the button lightly to activate the meter, for instance. You merely press it firmly all the way to trip the shutter. All other controls (speed-setting dial) and scales (shutter speeds, frame counter) are large, clear, legible, isolated and readily accessible.

Now that Pentax has the formula for the classic, simple, no-frills SLR body, what does it do for an encore? Probably nothing. The K 1000 is a rugged, solid, efficient camera that does its job well provided the user is willing to do most of the thinking and work needed to

## PERFORMANCE

| Our Standard                                                                | Tested    |
|-----------------------------------------------------------------------------|-----------|
| Focal length: ±5%<br>(47.50 - 52.50)                                        | 51.99mm   |
| Aperture: ±5%<br>(f/1.90 - f/2.10)                                          | f/2.02    |
| Distortion: (±1.5%)                                                         | <1%       |
| Light falloff: at f/5.6,<br>+1 stop from theoretical limit<br>(0-1.3 stops) | 0.5 stops |

## RESOLUTION

| Pentax 50mm f/2<br>at 1:52 Magnification |                      |                      |           |    |
|------------------------------------------|----------------------|----------------------|-----------|----|
| f/no.                                    | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 2.0                                      | Good                 | 46                   | V. Good   | 33 |
| 2.8                                      | Good                 | 52                   | Good      | 37 |
| 4.0                                      | Good                 | 58                   | Good      | 41 |
| 5.6                                      | Good                 | 58                   | Good      | 46 |
| 8.0                                      | V. Good              | 66                   | Good      | 46 |
| 11                                       | Excellent            | 66                   | Excellent | 52 |
| 16                                       | V. Good              | 58                   | Excellent | 52 |
| 22                                       | Good                 | 52                   | V. Good   | 46 |

## CONTRAST

| Pentax 50mm f/2<br>at 30 lines/mm |            |            |        |    |
|-----------------------------------|------------|------------|--------|----|
| f/no.                             | Center (%) | Corner (%) |        |    |
| 2.0                               | Low        | 30         | V. Low | 18 |
| 2.8                               | Low        | 30         | Low    | 20 |
| 4.0                               | V. Low     | 36         | Low    | 26 |
| 5.6                               | Low        | 40         | Medium | 36 |
| 8.0                               | Low        | 42         | Medium | 38 |
| 11                                | Medium     | 42         | Medium | 37 |
| 16                                | Low        | 38         | Medium | 34 |
| 22                                | V. Low     | 33         | Low    | 32 |

take pictures. It is also fully compatible with the current Pentax bayonet-mount optical system and, thus, available for use with a vast array of lenses and accessories.

**Field test slides:** Flare is a bit below average at maximum aperture and barely noticeable by f/5.6. Pictures lack snap at f/2 but show improved contrast by f/2.8. Sharpness holds well from corner to corner at f/2.8 and all smaller apertures.

**Optical bench analysis** (for optical experts only): On axis—slight red flare present. Slight spherical aberration noted to f/8, near theoretical diffraction limit at f/8. Off axis—slight orange flare present to f/5.6. Very slight astigmatism observed to f/8, point image near theoretical diffraction limit by f/8. (April 1983)

## PENTAX LX: NEW CHALLENGE TO NIKON

**TYPE:** 35mm eye-level single-lens reflex camera. **Body No.** 5215531. **LENS:** 50mm f/1.4 Pentax-M, No. 6081018, in interchangeable Pentax K bayonet, stops to f/22, focusing to 18 in. **SHUTTER:** Electro-mechanical titanium focal-plane with auto-exposure speeds from 125 sec. to 1/2000 sec.; manual speeds 4 sec. to 1/2000 sec. controlled mechanically from 1/2000 sec. to 1/75 sec. plus B, FP, X sync. **VIEWING:** Interchangeable eye-level prisms with interchangeable screens have central split-image rangefinder, micropism collar full-focusing screen, color-coded LED viewfinder exposure control with auto-exposure-compensation warning, over-exposure warning signal, shutter speeds

## 35MM Single Lens Reflex

and apertures, flash ready and O.K. visible. **OTHER FEATURES:** Two 1.5-volt silver-oxide or manganese batteries power silicon photodiode metering circuit with single cell in mirror chamber, reading center-weighted exposure from first shutter curtain and/or film for both continuous light and electronic flash measurement, ASA 6-3200, aperture-preferred auto-exposure, ±2 f/stops auto-exposure compensation, built-in eyepiece diopter correction, shutter release and shutter dial locks, film box reminder slot, mirror lockup, depth-of-field preview, gaskets to minimize dust and moisture entry, provision for multiple exposures, self-timer, provision for accessory motor drive, winder, data backs, bulk film magazines, hand grips, interchangeable strap fasteners. **PRICE:** \$998.00 with lens, finder.

Pentax cameras have been used by professional photographers ever since the first eye-level-viewing model of 1957. But other camera manufacturers, principally Nikon and Canon, have catered most continuously to the pros 'and advanced amateurs' need for a complete system camera featuring interchangeable finders, screens, motor drives and bulk film backs.

True, Asahi Optical has nodded in their direction with a limited series of pro-capable cameras having motor drives to fit special models of the Pentax Spotmatic II, F, ES II, KX and K2 DMD cameras. Neither screens nor finders, however, have been interchangeable. Motor drive speeds have hovered in the 2- to 3-fps vicinity rather than in the professionally-needed 5-fps range. By the time Pentax, in 1976, readied the full-fledged professionally-oriented, mechanically-based MX camera system, prospective purchasers were starting to drift towards fully-automatic, electronically-controlled cameras. Hence, Pentax was forced to begin again a search to the professional's and serious amateur's heart.

The new Pentax LX represents the fruits of some five years of research by Asahi's engineering and design group among photographers and photo technicians throughout the world as to what they wished in a camera system. From specifications, the LX and its accessories certainly strive for a completeness, sophistication and degree of ruggedness and solidity inherent in few other 35mm SLR cameras. We'll see how well they measure up.

Just where in the camera hierarchy is the Pentax LX aimed? Judging from its features plus complete system, right at Nikon's best.

In body size and weight, the Pentax LX falls midway between the Pentax MX and the Nikon F3. It is an aperture-preferred auto-exposure camera (you select the aperture and the meter system determines and sets the shutter speed) with full manual override. While the metering system, auto-exposure speeds plus manual speeds from 1/60 sec. depend on the well-being of two 1.5-volt silver or alkaline manganese batteries housed in the camera bottom, manual speeds of 1/75 sec. (X-sync) upwards are all mechanical, so they can be used when the battery is too cold, too weak, or absent—a feature not available on any other current electronically-controlled SLRs. In auto-exposure mode, the LX claims a formidable speed range of over 125 sec. to 1/2000. The meter system is unique, in that it uses but one single silicon



## What's New At A Glance: Pentax LX

Aperture-preferred auto exposure with manual speeds. 1/75 to 1/2000 sec. even without batteries

Unique strap and accessory grip connecting lug system

Frame counter also operates in rewind

Multicolored LED shutter speeds, apertures in finder

Dedicated flash hot sync shoe

Interchangeable screens and prism with variable diopter correction

Dust, moisture resistant interbody sealing

Auto-exposure-compensation dial

Combined self-timer/depth-of-field preview/mirror lockup lever

Accepts motor drive or winder, both with motorized rewind

Pentax K bayonet mount lens



photodiode centrally located at the bottom of the mirror chamber. This single cell faces backward toward the film and measures the light before and during the exposure from a patterned reflective surface on the first shutter curtain and/or the film itself. In this, it seems somewhat akin to the metering system of the Olympus OM-2. However, unlike the OM-2, it does not have separate cells in the prism housing reading the focusing screen for manual operation and finder information. Instead, 15 percent of the light entering the camera through the lens is transmitted through a semi-silvered, trapezoidal-shaped central section of the rapid return mirror. From there a folding secondary reflecting surface, hinged to the main mirror, redirects the light to the silicon cell. It is this arrangement that provides constant meter information to the viewfinder. When the shutter release is pressed, the secondary surface flips upward against the main mirror and both swing upwards, allowing the light from the lens to strike the first shutter curtain and/or the film itself. Thus you get center-weighted, film-plane readings for auto-exposure when shooting under continuous light or by electronic flash. This system is quite ingenious, and does away with the possibility that separate cells for viewing may give a different reading or pattern from the auto-exposure cells.

The metering system is not the only unique item on the LX. A glimpse through the viewfinder shows something of the advances seen in the Pentax ME Super, but the LX has gone far beyond that camera. At the right of the viewfinder, but within the picture area, is a vertical shutter-speed scale marked in unusually heavy black numerals (far easier to see than any similar

scale we know of). Outside the picture area, to the right of the scale, is a series of 16 multicolored light-emitting diodes. The top and bottom diodes are red to warn of over- and prolonged exposures. When you press the shutter release slightly, one or more diodes light for as long as the release is pressed or for 25 sec. afterwards if you remove your finger. Speeds from 4 sec. to 1/15 sec. are yellow, warning that they may blur motion and should be used only on a firm support such as a tripod. From 1/60 to 1/2000 sec. the diodes are green indicating "go," but there's a red diode at the X marking between 60 and 125 to denote X sync. This diode goes on when the special Pentax flash units are ready to fire, and flickers following exposure to indicate that the subject has been given the proper flash exposure. Centered above the picture area is the aperture window in which you see the lens opening you've set, reflected from the lens barrel itself. There are two other finder indicators: a transparent blue indicator covers the top "A" on the shutter-speed scale when the camera is used for auto exposure. On manual, the blue indicator travels downwards over the shutter speed you've set. When you use the auto-exposure-compensation scale, a large transparent red indicator appears above it.

When a dedicated Pentax electronic flash unit is slipped into the accessory shoe of the camera and has recycled completely, the red X-sync diode glows. If one of the Pentax dedicated through-lens-measuring flash units is attached, the red X will flicker if there has been sufficient flash illumination during exposure.

The camera body itself consists of a single main (metal alloy) casting of unusually heavy construction. While various con-

trols—such as the wind lever, shutter-speed dial and auto-compensation dials—are of plastic, all major parts of the camera body are of metal. The exterior is finished in black with a fine-grained, leather-like covering material. The LX is one of the few cameras to dispense with the traditional carrying strap eyelets—and instead has a specially designed accessory lug system, allowing the camera to be carried horizontally or vertically. The lug system also provides the support for accessory hand grips.

The LX has interchangeable finders and screens—not too surprising in a camera of this level. But the LX eye-level finders have dedicated hot-sync shoes, which is not only unusual but unique in interchangeable-prism cameras.

The special grommeting and sealing against dust, dirt and moisture are immediately evident upon removal of the prism or opening the camera back. Where ordinary felt-like, or sponge, light-tight sealing material is generally used, the LX has soft plastic seals, or rubberish, O-ring material. (Later on when we disassemble the camera to check parts for ruggedness, we'll peek inside to see if they've carried out further weather sealing.)

The Pentax LX is unique in offering random-access multiple-exposure capability. Not only can you make multiple exposures on top of the shot you have just made, but you can rewind back along the roll and multi-expose any shot previously made—thanks to a frame counter that not only advances when you wind but also reverses as you rewind.

The measure of any camera which considers itself part of a system suitable for professional use is obviously the sum of its parts. A camera which operates fantastically with magnificent lenses may well be far less useful and desirable to a serious amateur or pro than a camera which is less attractive with average pro-quality optics but that has a complete system of winders, motors, finders, special backs and lenses. We therefore intend to give you our opinions on the LX parts. How well does the camera behave on its own, how well with specific accessories, and lastly how well as part of the total system?

We did not find anything extraordinary about the LX's loading system—it is no more complex or sophisticated than the Pentax MX's. You pull up on the rewind knob, the back flies open and you insert the film leader into the very convenient multiple-needle take-up spool now common to all ME, MX and MV cameras. Winding film follows the normal pattern with the plastic-tipped rapid wind lever jutting out some 25° when in the operational standoff position. The 120° winding motion can be made in one single motion or several smaller movements. Many testers did not find the shape of the wind lever as comfortable as on other SLRs—the tip seems to press against the ball of their thumbs. However, certain controls like the wind lever will be available in Japan in several interchangeable configurations, so we expect these will find their way to the U.S.

Winding on film to the first exposure is done as in most SLRs. If you leave the lens cap on or are loading in low light with the camera set to automatic exposure, you may initiate rather long exposures when you're really trying to wind to first exposure



as quickly as possible. There are two remedies. Wind to the first exposure with the lens cap off and the camera pointing to an adequate light source, or switch to a manual shutter speed. The first is preferable since we found far too often that after switching to a manual speed we forgot to switch back again to auto-exposure operation. The blue manual shutter-speed indicator in the viewfinder simply wasn't a sufficiently outstanding warning to us. A blinking M would have been preferable (or better still, allow the camera to wind to exposure 1 manually even when on the automatic setting).

In rewind, the Pentax LX surprised us by having a distinct ratcheting noise which didn't please us until we discovered that the noise ceased as soon as the film leader was released from the takeup spool. In this manner the user can immediately stop winding and remove the film with the leader protruding, a distinct advantage for those of us who don't want to rewind the film completely into the cartridge but have done so all too often by pure accident.

Before using the camera, you should adjust the viewfinder diopter correction, even if you have never used correction on any SLR you've operated before. Why? The built-in diopter correction of the FA-1 finder commonly furnished with the LX allows you to fine-tune the focusing as you might fine-tune a high-performance race car. You slide the prism backwards slightly after unlocking it with the convenient latch. At the bottom of the prism, toward the back, you'll find a Phillips-head screw with a white dot and a white-lined dial running from 0 to -1.5. If you are normal 20-20 eyesight or better, and are not near- or farsighted, you would imagine that a zero setting would be correct for you. It probably won't be. Most SLR finders deliver about a -1 diopter correction built in. Therefore, if you see perfectly in other SLRs, you will probably wind up turning the screw about  $\frac{3}{4}$  of the way toward -1.5. Just look through the viewfinder at a plain white surface with the lens removed and turn the screw with the small tool furnished with each camera. Adjust until the shutter-speed scale and outline of the split-image rangefinder are crystal sharp. Then push the prism back to the lock position. The finder is now just right for your eye alone. Anyone else using the camera should go through the same procedure if he/she wants maximum focusing ability. One of MODERN's farsighted field testers who usually requires a +1 diopter correction on SLRs he uses, found that a near zero setting was perfect. However, if you are more far-sighted you may need additional plus correction. In this case you should purchase the camera with the FA-1W finder having a diopter correction from -3 to +1, about \$10 additional. This amount of correction will probably be sufficient for most photographers. However, if your needs are still beyond this range, additional diopter correcting eyepieces can be slipped over the viewfinder eyepiece.

We were most impressed with the variable diopter correcting system, which certainly gave us far more ability to achieve pinpoint-sharp finder focus than would the camera alone plus fixed diopter accessories. We have never seen a finder screen more clearly—and this should certainly

| GENERAL PERFORMANCE                      |                                                                                                                                                                                   |                                                      |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Checkpoints                              | Our Standard                                                                                                                                                                      | As Tested                                            |
| <b>FINDER:</b>                           |                                                                                                                                                                                   |                                                      |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                                                | 31 in. (0.8m)                                        |
| Apparent distance of shutter-speed scale | Between 51 in. (1.3m) and 22 in. (0.56m)                                                                                                                                          | 31 in. (0.8m)                                        |
| Apparent distance of aperture scale      | Same as above                                                                                                                                                                     | 20 in. (0.5m)                                        |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                                                                         | Vertical: 97%<br>Horizontal: 94%                     |
| Parallax error compared to film          | Vertical: 0.36mm<br>Horizontal: 1.08mm                                                                                                                                            | Vertical: 0.1mm (down)<br>Horizontal: 0.15mm (right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                                             | no discrepancy                                       |
| Image magnification                      | 0.90 $\pm$ 0.1X                                                                                                                                                                   | 0.86X                                                |
| <b>PICTURE SIZE:</b>                     | 24 $\pm$ 0.6mm x 36 $\pm$ 0.9mm                                                                                                                                                   | 24.3 x 36.2mm                                        |
| <b>SHUTTER:</b>                          |                                                                                                                                                                                   |                                                      |
| Curtain travel evenness                  | $\pm$ 0.33 stop                                                                                                                                                                   | 0.07 stop                                            |
| Camera insulation from sync              | More than 7 megohms                                                                                                                                                               | Infinity                                             |
| Sync contact efficiency                  | More than 60%                                                                                                                                                                     | 94%                                                  |
| Synchronizer delay time                  | X: within full opening                                                                                                                                                            | Okay                                                 |
| Shutter curtain bounce                   | Not allowed                                                                                                                                                                       | None                                                 |
| Self-timer delay time                    | 7-15 sec.                                                                                                                                                                         | 11 sec.                                              |
| <b>LENS:</b>                             |                                                                                                                                                                                   |                                                      |
| Focal length                             | 50mm $\pm$ 5%                                                                                                                                                                     | 50.00mm                                              |
| Maximum aperture                         | f/1.4 $\pm$ 5%                                                                                                                                                                    | f/1.42                                               |
| Distortion                               | $\pm$ 2.5%                                                                                                                                                                        | less than 1.0%                                       |
| <b>CAMERA SIZE:</b>                      | Body: 5 $\frac{1}{4}$ in. wide, 3 $\frac{1}{2}$ in. high, 2 $\frac{1}{2}$ in. deep (146.0x90.0x56.0mm)<br>Lens: 2 $\frac{1}{2}$ in. diam., 1 $\frac{1}{2}$ in. long (63.0x37.0mm) |                                                      |
| <b>WEIGHT:</b>                           | Body: 20 oz. (570g) with FA-1 finder<br>Lens and batteries: 8.0 oz. (236g)                                                                                                        |                                                      |

translate itself into more sharply focused photos in the long run for most of us.

If you've correctly loaded your two 1.5-v alkaline manganese or silver-oxide batteries into the bottom battery chamber, and pushed the shutter release lock lever to the off position, you can now press the release gently and look at all the pretty diodes in the finder (which we've already described). Like all Pentax diode systems, only one LED will light at a time for auto exposure, even though the precise infinitely variable speed will usually be set by the meter circuitry somewhere between the numerals. This is a deliberate bit of electronic engineering to prevent the confusion that is sometimes created in other SLRs with two diodes on at the same time or perhaps one on and one flickering. In average illumination conditions—bright lights indoors or shade or overcast—the diodes, plus the aperture reflected from the lens barrel, the blue manual shutter-speed pointer and red auto-exposure-compensation flag can all be seen quite easily. When light overhead is poor, however, the apertures can become difficult or impossible to see. The diodes are not as outstandingly bright in sunlight and must be observed carefully. The shutter-speed scale can be hard to read in very low-light illumination but Pentax has again added a unique feature. The shutter speed numerals have a very high

golden reflectance on top so that the least amount of illumination from the rear through the finder causes the entire scale to be lit by reflected light. You will have to play around with this feature until you catch the hang of illuminating the scale from the finder side. However, even if you're photographing in near pitch darkness, the color-coded LEDs will indicate whether you have a hand-holdable shutter speed or not.

Because the LX is a professional and serious amateur camera, the makers think it will have more prolonged and constant use than other Pentaxes. Accordingly, they have suggested that the battery life will be only several months, unlike the optimistic (and usually incorrect) instructions for other cameras that state one year is a proper lifetime. We found the recommendation to be quite accurate, so LX owners should keep additional batteries handy at all times. The addition of a winder or motor does not couple the battery juice from these accessories to the camera exposure system or shutter.

If some 15 percent of the central illumination from the lens travels through the semitransparent rapid-return mirror center to feed the metering cell, doesn't the availability of just 85 percent going through the finder cause a loss in viewing illumination? Not a bit of it. Because of the Pentax LX's



## 35MM Single Lens Reflex

excellently-designed viewing system, which involves much silver coating of surfaces, the brightness is excellent.

The image magnification within the viewfinder is less than that on many amateur-oriented cameras. However, this is in keeping with other professionally-oriented cameras, such as the Nikon F3, where viewfinder informational material is located outside the picture frame. In the Pentax, the aperture window, light-emitting diodes and the entire viewing screen can easily be seen even by eyeglass wearers (although, admittedly, switching your eye from the top aperture window to the side shutterspeed scale is not as convenient or comfortable as having all information in one place). The central rangefinder and microprism, almost identical in size and construction to that on the Pentax ME Super, were easy to use with all lenses having apertures of f/5.6 or larger. For smaller maximum lens openings as on other SLRs, it's necessary to focus with the outer fine-focusing area.

The shutter-release button has a fairly long (5mm) travel. It's a very smooth mechanical control, deliberately not made electromagnetic so that it can still operate at the mechanically available 1/75 sec. to 1/2000 sec. shutter range when batteries fail or are unavailable. Shutter and mirror noise are about average for an SLR. Oddly enough, unlike most SLRs, the actual sound of the shutter speeds from 1/60 sec. to 1/2000 sec., are exactly alike. In most SLRs there is a distinct quickening of the sound as speeds are increased. Photographers who do rely on shutter noise to give them a rough indication of the speed will not be able to do so with the Pentax LX.

The metering system is, in our opinion, the most sophisticated on any SLR today. While we do have a number of SLRs now with off-the-film, through-lens auto-exposure control for continuous light and/or flash, the LX is the only one to use but a single cell within the mirror chamber for all exposure measurements.

Our practical and laboratory tests on the metering system were satisfying indeed, with highly accurate lab readings obtained and well-exposed 35mm slides produced in our field tests.

The Pentax LX has a convenient auto-exposure-compensation dial with  $\pm 2$  f/stop auto-exposure variation. This total range is available from ASA 25 to 1600 with slightly less compensation at ASA 6, 12, 1600 and 3200. We consider this more than ample. As an alternative to auto exposure, you can of course use manual speeds from 4 sec. upwards (or from 1/75 sec. in case batteries fail). With battery power, the LEDs within the finder will continue to indicate suggested shutter speeds for any aperture set. The light blue transparent pointer will indicate the shutter speed you select. Bracketing exposures using this method of exposure determination is very convenient.

The LX does not have an exposure memory hold to allow you to make a close-up reading of a subject, "hold" it while you return to camera position and then release the shutter. This is not an oversight. Cameras offering through-lens flash and continuous light measurement from the shutter curtain and film itself do not have memory hold electronics because they don't need them. Cameras not using off-the-film measurement for all auto exposure need a

memory which "locks" the exposure before the mirror flies up and "holds" it until the exposure is complete. Exposure measurement with cameras such as the LX is continuous, even after the shutter is released. Thus a change in lighting can alter exposure during the actual exposure itself—a most useful feature during long exposures—such as at night, where the illumination might suddenly change. The LX metering system accommodates this kind of change; cameras with memory hold electronics cannot.

Because the Pentax LX measures all exposures using the single backwards-facing silicon cell in the mirror chamber, no extraneous light from the viewfinder affected either our manual or auto-exposure readings. No viewfinder blind was needed. Additionally, focusing screens and finders could be interchanged without exposure compensation.

While finders can be changed with alacrity, we found screens must be interchanged carefully from within the camera mirror chamber using a specially furnished tweezer-like pincer. Why not change from on top? Because there's a fixed surface which has the shutter-speed scale engraved thereon and is non-interchangeable. Finders are taken off on top and screens removed from below but the shutter scale surface remains fixed.

When using standard polarizing filters, we noted that pre-exposure readings were often inaccurate, because metering systems transmitting light through a semi-transparent surface do not give proper readings through polarizing filters (unless the filters themselves are of the quite expensive so-called circular types, such as those made by Leitz). However, thanks to the direct off-shutter film-reading metering system, the actual exposures made through all polarizing filters with the LX were quite accurate.

The Pentax LX has quite an amazing range of auto-exposure speeds, according to specifications and as confirmed by our tests. Should you be using Kodachrome 64 for a night shot, for instance, the metering system can provide an accurate auto exposure of over 4 min. at f/1.4! (If you are using a film requiring reciprocity-failure correction, you can make a first exposure, time it and then make your filtration correction and your exposure correction using the auto exposure compensation dial.) As higher ASA speeds are used, the longest exposure possible does become abbreviated. With an ASA 400 film, for instance, an exposure of about 50 sec. is maximum according to our tests. Manual-shutter-speed exposure couplings are somewhat more restricted, due principally to the lack of any manual speeds over 4 sec.—but what camera other than the LX has any manual speeds that long to begin with? In all, it's a most impressive, thoroughly professional, highly flexible metering system with a peerless range.

The multiple-purpose lever at the front of the LX is well thought out. Push the center lever button and turn the lever away from the lens mount and you have a 12-sec. self-timer (which can be set for shorter periods). Once set, it is still cancellable instantly simply by turning the lever vertically again. While the timer is mechanical, not electronic (and therefore works with or

without battery power), it has a prominent white stripe down its length—so that by its position the subject can be warned when the shutter is about to be released.

Push the lever toward the lens mount and it will instantly stop down to your present aperture so you can view the depth of field. Press the center button and push the lever if you want to stop down the lens and simultaneously raise the mirror to the locked-up position for very delicate, vibrationless work such as astrophotography or photomicrography. We did come across one fascinating feature here. The LX is the only through-lens-metering camera that can make automatic exposures in flash or continuous light with its mirror locked up! While admittedly you can't view your subject with the mirror locked up, you can check the exposure since the aperture window is still visible in the finder and you can generally see the entire aperture scale (plus the diodes, of course) lit by viewfinder-reflected light as we've already described. So if you have your camera on any rigid support and the subject isn't a moving one, you can easily make use of the most vibration-free auto exposure available on any camera of this type.

We don't wish to imply by our concentration on the rather versatile mirror-lockup and exposure system of the LX that using the LX with its rapid-return mirror operating is vibration-prone. It is not. What we first thought of as rather excessive camera movement caused by the shutter mechanism turned out to be caused totally by the rapid-return mirror returning to down position following exposure. Shutter release, first shutter curtain travel and mirror raising are remarkable in their smoothness and lack of effect on the camera itself.

We've left the LX with its mirror still locked upwards and its lens closed down. To return the mirror and lens diaphragm to normal viewing, just push the lever's center button, and it occurs immediately.

The lens-mount system of the LX barely requires mentioning, since it's the now very well established and accepted Pentax K bayonet. As might be expected of a pro camera, the LX's lens-mount face ring is of stainless steel, a more preferable metal to the usual brass since the steel wears far less under heavy continuous use. As with other cameras using the K mount, we found lens interchangeability swift and efficient with no loose play.

While once we were quite satisfied with a simple waist-level finder and high-magnification finder alternatives to the furnished prism finders of top-level SLRs, manufacturers have increased our options with other alternatives. The LX goes beyond that with three eye-level prism finders (the FA-1 and FA-1W already discussed), the FA-2 (an FA-1 with no hot shoe or aperture visible in the finder), the FE-1 high-magnification waist-level finder (\$140) for close-up and critical focusing work, with diopter correction from -5 to +4, and an FB-1 system finder. The FB-1 base fits atop the LX. To it you can attach the FC-1 variable eye-level/waist-level eyepiece sports finder (\$83), the FD-1 45° Waist-Level Eyepiece with -5 to +3 diopter correction, or the FD-2 Standard Eyepiece, similar to the FD-1 but without its diopter correction. All FB-1 system finders show apertures and a correct, left-to-right, unreversed image of the entire scene. The



FE-1 shows no apertures and the view is reversed. A complete analysis of these would send us into overtime or extra innings. Suffice to say that each is very useful but we feel one eye-level prism and the FB-1 system finder minus the FD-2 standard eyepiece would be all that even the most critical professional worker would ever need. The FE-1, by the way, is excellent for photomicroscopy, where you will be using a cross-hair viewing screen for focusing.

One traditional Pentax indicator that we should not forget mentioning is the quite useful shutter wind indicator, a small window in front of the shutter-speed dial which shows a red signal when the film and shutter are wound, ready for exposure.

Addressing ourselves now to the camera body indicators, we have to give grudging admiration to the new Pentax style of employing raised shiny numerals against a matte black background both on the shutter-speed dial and auto-exposure-compensation dial. With bright overhead illumination they are quite easy to see, but in poor light much less so. While it might indeed look far more garish on the all-black camera, we would prefer a white on black shutter-speed dial—or perhaps even one whose shutter speeds are color-matched to the shutter-speed LEDs within the viewfinder. However, like the shutter wind lever, we have been told that alternative shutter-speed dials will be available on the Japanese market and maybe on ours. All other controls—apertures, f/stops, frame numbers—are highly visible.

Although the carrying strap system is not usually considered a part of the camera proper, the Pentax LX approach represents a complete departure from standard 35mm SLR practice.

Aside from a few exceptions like Alpa to prove the rule, SLR cameras traditionally have provided small carrying strap eyelets at the camera ends through which some sort of split ring is generally threaded. To these split rings, the camera carrying straps are attached. When camera makers discovered the brass eyelets were wearing through under hard use, steel inserts appeared within the eyelets on new cameras. This carrying system, while allowing many diverse types of straps to be fitted, often proved ineffective in preventing the split rings from somehow unthreading and dropping the camera. Secondly, the split rings themselves often rubbed against the camera, causing abrasions and the wearing of the chrome or black enamel on the camera body.

The Pentax LX does not have eyelets. Instead, there are three accessory lugs at the top edges and bottom left side of the camera. An adjustable, woven nylon carrying strap, ½ in. wide, is provided with a cloth-backed center section 1 in. wide (to prevent shoulder slippage and make camera carrying more comfortable). At either strap end is a swiveling tab fastener which fits over the lock securely against the lug. The camera can be carried horizontally or vertically. At the bottom right side of the camera front is a threaded socket. Using the top lug and the socket you can fasten on your choice of two accessory grips—Grip B, which is contoured for the most users, and Grip A, which can be shaped to your own needs with a knife and sandpaper—a nice touch. We found that the Grip B suited most testers' hands well, and

the camera was indeed easier to hold with the grip. However, when the grip is attached, the camera cannot be carried horizontally—which might be inconvenient should you be photographing with two Pentax LX cameras carried around your neck, on your chest. Still Pentax must be applauded for at last tackling one of the primitive SLR features and improving it vastly. (Should you prefer some other strap than Pentax's, you can purchase the swiveling fasteners alone for \$4 apiece and attach your favorite carrying strap to them.)

In our field tests of the camera we were quite impressed with the Pentax LX (aside from the minor criticisms already voiced). We found that it provided us with a versatility and flexibility hard to match in any other 35mm SLR camera, and in some areas, such as exposure, unmatched.

Let's now turn to flash. The hot shoe on the interchangeable eye-level prisms is a triumph of clever design. In the shoe you may slip the foot of any flash unit with a hot sync foot. However, the Pentax units do offer distinct advantages. The AF 160 and AF 200's dedicated flash available for the Pentax MV-1 and ME Super do automatically set the speed to the 1/75 sec. sync when the LX is on automatic exposure and will also cause the X LED to light when the camera is ready to fire. However it is only with the two new flash units, the hot shoe mounted AF-280T and the head-and-handle shaped, bracket-mounted AF-400T that you obtain through-lens autofocus metering plus flash O.K. check.

The AF-280T, powered by four AA cells, slips atop the hot shoe and locks in place. The flash head can swivel 90° on each side with 45° indents and can also tilt upwards 90° or depress downward 15° for close-ups. The flash covers the angle of a 28mm lens, while a wide-angle adapter (\$8) and tele adapter (\$14) allow lenses to 24mm and upwards of 85mm, respectively, to be used with best efficiency.

Unlike the dedicated flash units for cameras not having through-lens flash metering which must be used at specific apertures, the AF-280T can work at any aperture you choose. With ASA 100 film the f/22 exposure range is from 0.8 ft. to 4.3 ft., excellent for closeups, while at f/1.4 the auto range extends from about 10 ft. to 65 ft. A calculator guide on the back of the AF-280T provides the maximum distance range for any aperture you choose. There is a flash check light on the back of the unit plus the red LED opposite X in the finder which both flicker following exposure if there has been sufficient illumination. (Our early production LX instruction manual claimed that you can check through-lens-metering flash by pressing the auto-exposure check button on the back of the unit, but this is not so.)

The check button only works with non-through-lens auto flash metering using the flash unit's own built-in direct sensor. This is a separate auto-exposure system which works on the LX or any hot-shoe-sync camera.)

The manual ASA 25 guide number of the AF-280T is 46 and the ASA 400 guide number is 185. When operating at the TTL (through-the-lens) Auto setting, the flash will only fire if the camera shutter speed as seen in the viewfinder is 1/30 sec. or below. At higher speeds where there is sufficient light to operate without flash, the

camera's own auto-exposure system takes over and the flash will not fire. At slower than 1/30 sec., the flash exposure takes into consideration not only the unit's own flash but also all existing light as well.

Besides regular TTL auto-flash exposure, the AF-280T has two different aperture ranges for direct auto exposure using the unit's own metering cell plus both full-power and low-power manual operation which work with the flash-ready indicator.

Using any of these four alternatives, the flash-ready X-sync LED still lights, and again you are prevented from shooting automatically or manually at speeds faster than 1/30 sec. However, should you wish to override the whole system and use flash at whatever aperture you wish, there is a full-power M (for manual) setting which allows just this.

The unit operated perfectly for us although we found the 10-sec. manual or maximum auto distance recycling time with fresh batteries to be rather long, particularly when it lengthens considerably as more flashes are used. On TTL Auto however, the energy-saving circuit does cut recycling time considerably, resulting in far more flashes than the 150 minimum which would be achieved either in manual operation or at maximum auto-exposure distances.

We have only one negative comment concerning the flash/camera sync system. If by accident you should possibly turn your shutter-speed dial off automatic and onto a high speed such as 1/2000 sec. and then use the TTL Auto flash setting, the Auto Check signal on the flash unit as well as in the viewfinder would indicate that a sufficient light exposure had been made, even though the truth is that the shutter speed was far too fast to make a flash exposure at all. Why then the flash O.K. signal? It was caused by the flash reflecting from the patterned first shutter curtain, thus providing the exposure check light with a false flash O.K. indication. While, admittedly, photographers shouldn't attempt to shoot auto-flash while set to a manual shutter speed, it can and does happen. Some sort of flash-check cut-off circuit which would operate at any speed faster than x sync would rectify the problem.

While Pentax—at least at present—has no flash cord to allow the AF-280T to be used off camera for reflector flash, variation in flash modeling light or using the flash for slide copying, New Ideas, Inc., does make a Duo Sync Cord for \$19.95 which we found works nicely.

For those requiring more power and the possibility of alternate power sources such as high-voltage packs and AC in a unit specifically designed for off-camera operation, Pentax has the head-and-handle AF-400T flash unit which attaches physically to the LX by a tripod-socket-mounted angle bracket and electrically via a dedicated sync cord. The cord uses the camera's PC cord plus two additional contact points near the side of the lens mount.

The AF-400T head swings and tilts in much the same manner as the AF-280T has a distance range with ASA 100 film of from 10 ft. to 93 ft. at f/1.4, a manual ASA guide number of 65 for ASA 25 film and 260 for ASA 400. The six AA cells in the handle delivers upwards of 75 manual flashes, the angle coverage is sufficient for a 28mm



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lens, the unit accepts the same wide-angle and tele attachments as does the AF-280T. Besides the Auto TTL setting, the AF-400T provides a three aperture range for direct autofocus, a manual sync setting with finder flash indication and a full manual operation with no visible indication in the finder. There's also manual light-intensity control with 1/25, 1/16 and 1/4 power settings. At large apertures, the unit can be synched to the camera for motor or winder sequence shots. Regrettably, time and space did not permit us to test this unit out.

Turning now to the LX winder, the word "unique" again is needed. The LX winder, which is powered by four AA cells and, according to our tests, can advance film in single shots or bursts up to 2 frames per sec., is the only winder on any SLR which also offers motorized rewind. (This takes 12 sec. for a 36-exposure roll, according to our tests.)

The winder fits neatly below the camera, but first you must remove the drive and rewind shaft covers from the bottom of the camera and thread them into the two receptacles atop the winder. Why is it necessary to remove two covers when only one cover need be removed on the other SLRs? Remember, the LX is protected against dust and moisture to a greater extent than other SLRs. Should the camera's drive or rewind mechanism connections for a winder or motor be exposed without a cover, the protective sealing would certainly be breached. Covering the camera bottom with two covers does make the bottom moisture- and dust-resistant. Even the four-point electric contact of the winder has a resistant O-ring grommet so that dust or moisture will be minimized in this area. How dust- and moisture-resistant is the camera with the winder attached? Almost as much as without the winder. The two wind and rewind claws which reach into the camera have plastic sealing grommets which work effectively.

With fresh alkaline batteries in the winder we were able to achieve precisely 2 frames per second on continuous bursts. On one set of alkaline AAs we were able to wind and rewind over 40 rolls of 36 exposures. Besides being activated by the camera shutter release, the winder can be set off by remote control via its electric remote control socket which also allows an intervalometer to be fitted for time sequence photography.

According to specifications, when the winder is operational, there should be 2mm of shutter-release travel between the viewfinder display lighting and the winder operating. We found it most difficult to light the display without setting off the winder. To avoid unwanted exposures we found it advisable to light the display with the winder turned off, and then turn the winder on. Asahi, when contacted, said that this was a fault which should not occur, that it would be investigated and rectified on any cameras reaching consumers.

If you attach or detach the LX winder in mid-roll, Asahi warns that there is a possibility of film fog when done in sunlight or under a bright lighting source. We found that it could be safely attached or removed in the same type of minimal light in which you might load or unload film.

The Pentax LX Motor Drive can be powered by 12 AA size alkaline batteries in a ver-

## RESOLUTION

| SMC Pentax 50mm f/1.4<br>at 1:50 magnification |                    |    |                    |    |
|------------------------------------------------|--------------------|----|--------------------|----|
| f/no.                                          | Center<br>Lines/mm |    | Corner<br>Lines/mm |    |
| 1.4                                            | V. Good            | 50 | Excellent          | 40 |
| 2                                              | V. Good            | 56 | Good               | 40 |
| 2.8                                            | V. Good            | 71 | Good               | 50 |
| 4                                              | V. Good            | 71 | V. Good            | 56 |
| 5.6                                            | Excellent          | 80 | V. Good            | 63 |
| 8                                              | Excellent          | 80 | V. Good            | 63 |
| 11                                             | V. Good            | 63 | Excellent          | 56 |
| 16                                             | Good               | 56 | V. Good            | 50 |
| 22                                             | Acceptable         | 56 | V. Good            | 50 |

## CONTRAST

| SMC Pentax 50mm f/1.4<br>at 30 lines/mm |          |    |          |    |
|-----------------------------------------|----------|----|----------|----|
| f/no.                                   | Center % |    | Corner % |    |
| 1.4                                     | Low      | 34 | Low      | 20 |
| 2                                       | Low      | 46 | Low      | 20 |
| 2.8                                     | Low      | 50 | Low      | 32 |
| 4                                       | Low      | 58 | Low      | 42 |
| 5.6                                     | Low      | 54 | Medium   | 47 |
| 8                                       | Low      | 51 | Medium   | 46 |
| 11                                      | Low      | 48 | Medium   | 44 |
| 16                                      | Low      | 45 | Low      | 39 |
| 22                                      | V. Low   | 38 | V. Low   | 34 |

tical Battery Grip M or by means of a horizontal NiCad Battery Pack M which requires but 6 hrs. to recharge from full discharge using the Charge Pack M. There's also an AC connected Power Pack M incorporating a built-in variable-interval timer. The motor fits in the same manner as the winder but offers variable continuous speeds from 0.5 fps to 5 fps plus motorized rewind in 9 sec. (according to our tests). In cold weather either the Battery Grip M or NiCad Battery Pack can be removed from the motor proper and operated from a warm pocket using a remote control cord. Using the motor plus AA-cell hand grip, we were able to wind and rewind more than the stated minimum of 30 rolls of 36 exposures. We do, however, recommend the NiCad battery pack, which will handle over 20 rolls per charge. It eliminates the long vertical battery-holder handle, can operate in colder weather and, if you use the motor with any consistency, will certainly be cheaper than replacing 12 AA size alkaline batteries when they run down. We had only one slight reservation concerning the motor drive. The motor tripod anchor screw holds the top plate of the motor securely against the Pentax LX camera body. But there is no support for the tripod anchor screw except the motor's metal top plate, which itself is held in place by seven very short Phillips-head screws. Should unusual force be applied, especially on the Battery Grip M, it might be possible to strip the screws and tear the motor from the top plate. While admittedly this is a remote possibility, we do feel that, as a safety measure, the screws should have been longer and of greater diameter.

The LX motor, like the winder, performed up to all specifications. The braking mechanisms of both winder and motor instantly halted film advance at roll end, thus avoiding and possibility of having film ripped from the supply spool or creating torn film sprocket holes.

Thanks to Asahi's concern that all parts of the LX system should be made available at the same time as the camera, we were able to examine the Dial Data LX Back

—which overprints the date, technical data or filing information directly on the negative or transparency—plus the Data LX Back which prints the time-plus a short message in the center of the clock face. Both of these are long-time Pentax accessories but now have been incorporated into backs to fit the LX. The LX itself already has the necessary swinging film blind built into provide the clock face with a suitable blank spot in one picture corner.

The 250-exposure Bulk Film Back (\$652) is somewhat similar to bulk backs on previous Pentax SLRs, but the mechanisms have been improved. It can be used with or without the Motor Drive. Again, time and space did not allow us to test these units.

The Pentax LX camera and system certainly represents a strong challenge to all others in its class. We have pointed out specific teething problems, not an uncommon occurrence for the emergence of a whole new camera system, but none render the camera non-operational. More important, the Pentax's strengths—many of them unique, as we've pointed out—do offer the owner specific advantages in part and sum not available on any other SLR of any class. Although we did not attempt to dunk the Pentax in water or fine dirt to test its dirt- and moisture-resistant qualities (and we don't advise you to either), the sealings do definitely work. While the camera itself appears deceptively simple, it has all any top pro needs and then some. As important for those who have emotional ties as well as objective feelings about their camera, the Pentax LX is likable and enjoyable to use.

**Optical bench analysis:** On axis, at maximum aperture we detected slight yellow-orange flare and slight overcorrected spherical aberration. However, the flare was greatly reduced by f/2, the lens virtually free of all defects (diffraction limited) by f/2.8 and completely free of all defects by f/8. Off axis, there was some skew-ray flare with slight coma and astigmatism at f/1.4 with all but the astigmatism disappearing by f/8.

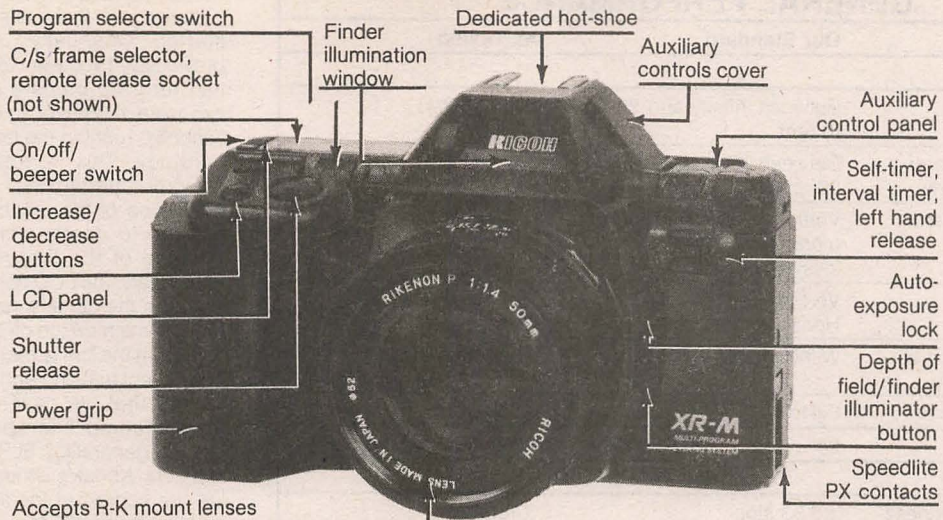
**Field test slides:** While at f/1.4 our slides were slightly soft (mostly attributed to an extremely shallow depth of field even at great distances), slides showed excellent saturation and consistent exposures over a wide range of subjects with excellent crispness and defined detail at smaller than maximum apertures. Very slight blue lateral color was detected. (Jan. 1981)

## RICOH XR-M: GREAT VERSATILITY

**MANUFACTURERS SPECIFICATIONS:** Ricoh XR-M 35mm single lens reflex, Body No. 25 125838. LENS: 50mm f/1.4 Rikenon P 103586 in R-K (modified K) mount. SHUTTER: Copal vertical-travel metal-bladed focal plane, with manual operation from 16 seconds to 1/2000, aperture-preferred autoexposure from 30 seconds to 1/2000, 1/100 second flash sync. Motor-driven film advance with auto/manual electric rewind. EXPOSURE SYSTEMS: Action, depth and normal programs; shutter-bias AE; aperture-priority AE, match-diode manual; three special TV modes. One



## What's New at a Glance: Ricoh XR-M



dual SPD cell reads centerweighted average, spot (four percent of finder area), or backlight-compensating dual pattern for ambient light exposure. EV 0-18 (at ISO 100, with f/1.4 lens). ISO 12-3200, compensation 24 stops in 1/3 stop increments, exposure lock. **FLASH:** Dedicated hot shoe and/or PX clip on unit (using camera batteries as power supply), utilize SPD metering cell in mirror chamber reading directly from film; sync speed set for all modes but manual; aperture automatically set for program and shutter bias flash. **VIEWFINDER:** Non-interchangeable eye-level prism with diagonal split-image rangefinder, micropism collar, full-area focusing; metering area and exposure mode set, exposure locked, exposure compensation, overexposure and underexposure warnings, flash-ready and OK, speed set and speed recommended and aperture figures indicated in colored, automatically back-lit LCD panel in finder. Screens changeable at service centers. **OTHER FEATURES:** Automatic finder information illuminator; LCD panel on body indicates film status, frames exposed, battery condition, winder mode, autoexposure mode or manual settings, confirms DX loading, number of frames on roll, double and multiple exposure control; film identification window; ten-second self-timer resettable from one second to 60 minutes, usable as intervalometer or long exposure control, auxiliary left-hand shutter release; audible, cancellable, confirming beep, manual and automatic main power switch. Manual ISO settings. **BATTERIES:** Four AA batteries in detachable left-hand grip. Optional battery holder for four AAA batteries available. **PRICE:** Body, \$449; with 50mm f/2, \$509; with 50mm f/1.7, \$547; with 50mm f/1.4, \$627; PX flash, \$92.

Ricoh's XR-P, an unusually versatile, multi-program automatic SLR introduced in 1984, was a hard act to follow. (To find out just how feature-laden this camera actually is, check out our November, 1984 *Modern*

*Tests.*)

It took less than three years for Ricoh to produce an updated version, the XR-M, a camera as easy to use as a point-and-shoot compact and with more scope than many professional SLRs. The XR-M is unusual in that it offers at a reasonable price the convenience and flexibility of the latest generation of autofocus SLRs without being autofocus. If you have a heavy investment in Pentax K, KR and even Pentax screw threaded lenses, the XR-M will use them all with second-generation automatic convenience.

Push buttons and sliding switches select and control the camera's spot, averaging and backlight-compensated metering, three programmed autoexposure modes, aperture-preferred autoexposure, shutter-biased autoexposure and full manual settings. But there's more to the XR-M than push buttons.

Only the enlarged right-hand grip hints that the XR-M's slim body contains a three-fps motor drive with automatic film loading and automatic rewind. A sliding cover at the left end of the gray, fibre-reinforced plastic body opens to reveal electronic contacts for the film-box sized Speedlite PX. Once it's mounted, you'll probably never remove it—its 2.6 ounce weight and 1/16 inch width add little bulk to the XR-M.

No longer do you have to worry about setting film speed; contacts in the Ricoh's film chamber read the DX codes on the cartridge and set speed and length into the camera's electronic brain.

As much as we hate to embrace the hackneyed computerese phrase, this camera is "user-friendly." The way it does what it does is very direct and straightforward. It wakes up, ready to go, preset to any mode desired, when you turn it on.

Want to leave programmed automation? Just set the lens to your desired aperture and the Ricoh changes to aperture-preferred mode automatically. Using flash? Just turn the flash on! In any program mode, the camera sets both shutter speed and aperture correctly. What's more, the TTL/OTF metering cell in

the base of the mirror box quenches the flash at the right instant.

Taking more than one leaf from their own point-and-shoot electronic rangefinder cameras, Ricoh has made their new SLR difficult to make a mistake with, as we shall see when we begin to go through its operation in detail.

But unlike some point-and-shoot cameras, the XR-M is simple, not simple-minded, and, in fact, has all the features of a pro-grade SLR and then some. Particularly interesting are its flexible TTL/OTF flash system; the combined features of its intervalometer, self-timer and long exposure timing; and the clarity and comprehensiveness of its viewfinder readouts.

Like a point-and-shoot camera, the XR-M positions the first exposure, sets itself for film speed and length, goes into a carefully planned exposure program, has add-on flash that's nearly foolproof, and rewinds automatically when the time comes. Unlike its less ambitious brethren, it does all these things without taking away your control options. In manual mode, its controls bring together a speed range from 1/2000 second to 16 seconds. The intervalometer can be set from one second to 60 minutes (which will also control time exposures up to an hour). Its TTL/OTF flash automation can be used from 1/100 to 16 seconds (to blend ambient light with flash).

Let's power-up the XR-M and put it through its paces.

You don't need a yen to remove the XR's battery cover—anything south of a quarter will do the job. Four alkaline AA batteries pop into the cover of the hand grip and are firmly held by coil spring contacts. Polarity markings are cast into the plastic housing but are hard to see in dim light. One battery nestles deep within the holder; it should be inserted first as the space is a bit tight. Since all the batteries are in the grip itself, the camera interior is well protected against damage in the unlikely event of battery leakage. Six gold-plated contacts carry power to the camera circuits.

A somewhat more compact grip, which



## 35MM Single Lens Reflex

| GENERAL PERFORMANCE                      |                                                                                                                  |                                                  |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Checkpoints                              | Our Standard                                                                                                     | As Tested                                        |
| <b>FINDER:</b>                           |                                                                                                                  |                                                  |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                               | 39 in. (1.0m)                                    |
| Apparent distance of shutter-speed scale | Between 79 in. (2.0m) and 26 in. (0.7m)                                                                          | 39 in. (1.0m)                                    |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                        | Vertical: 92%<br>Horizontal: 91%                 |
| Parallax error compared to film          | Vertical: 1.0mm<br>Horizontal: 1.6mm                                                                             | Vertical: 0.4mm (up)<br>Horizontal: 0.3mm (left) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                            | No Discrepancy                                   |
| Image magnification                      | 0.81X±.1X                                                                                                        | 0.81X                                            |
| <b>PICTURE SIZE:</b>                     | 24 ± 0.6mm x 36 ± 0.9mm                                                                                          | 23.9mm x 36.0mm                                  |
| <b>SHUTTER:</b>                          |                                                                                                                  |                                                  |
| Curtain travel evenness                  | ±0.33 stop                                                                                                       | 0.13 stop                                        |
| Insulation from sync                     | More than 7 megohms                                                                                              | Infinity                                         |
| Sync contact efficiency                  | More than 60%                                                                                                    | 71% (hot shoe)                                   |
| Sync delay time                          | X: within full opening                                                                                           | Okay                                             |
| Shutter curtain bounce                   | Not allowed                                                                                                      | None                                             |
| Self-timer delay                         | 7-15 seconds                                                                                                     | 10 seconds                                       |
| <b>CAMERA NOISE:</b>                     | 71 dB(a), very quiet for a motorized SLR                                                                         |                                                  |
| <b>CAMERA SIZE:</b>                      | Body: 6 in. wide x 3¼ in. high x 2¼ in. deep (151 x 92 x 59 mm)<br>Lens: 1¼ in. long, 2 in. diameter (32 x 62mm) |                                                  |
| <b>WEIGHT:</b>                           | Body: 17½ oz. (491g) with batteries<br>Lens: 5⅞ oz. (146g)                                                       |                                                  |

takes four AAA batteries, is available as an accessory but if you're heavily into flash, AAs are your best bet. Using flash for every other shot, Ricoh claims 55 24-exposure rolls for AAs, as opposed to 18 for AAAs at normal temperatures. Nicads may be used but their slightly lower voltage may slow down operation.

A multi-stage battery symbol on the body LCD shows your energy picture constantly. As the batteries drain, the black center of the diagram gets smaller, disappears, then the whole outline pulses. Even tired batteries retain the number of frames exposed, film speed settings, exposure overrides and other settings in the XR-M's memory, so don't remove them until you've got spares ready to load. When batteries weaken, the motor drive automatically slows to two fps, then begins to turn itself on and off to save juice. If batteries are low, rewinding of non-DX coded film may have to be initiated manually by pressing the rewind button with a pen tip.

In cold weather, battery level seems to drop rapidly, recovering when the camera warms up again. Having the batteries in the hand grip helps keep them warm if you hold the camera in gloved hands.

A three-position sliding switch at the right end of the body powers all circuits. A piezoelectric beeper, which confirms flash-ready/sufficient exposure and monitors the self-timer and most button-actuated settings, may be selected at one switch position. The XR-M automatically turns itself off 30 seconds after the last operation, but touching the shutter release brings it back into action. All camera settings are retained in memory in any

event.

Film loading's a snap. Open the back's one finger, two-step release, put in your film, pull the leader out to the loading mark and close the back. Film advances to the first exposure almost instantly. The double-cartridge LCD symbols we've become used to on point-and-shoot cameras confirm every step of the loading and rewinding process.

One of Ricoh's technical innovations is the introduction in this camera of sprocketless film advance to ease auto-loading and to enable the use of a more energy-efficient motor. A low-powered infrared LED light source shines through the sprocket holes onto a sensor; pulses are counted as the film is wound forward, then the film stops, ready for the next exposure. Positioning of the exposures on the roll is even and accurate. The concentrated, infrared beam passes through the film between the sprocket holes and leaves a barely noticeable pattern on the edge of the film. This does not in any way affect the picture area. We found that the consistent 2mm wide spaces between frames made film cutting much easier.

Camera noise is minimal and subdued. The short, dry, middle-toned squeak merges motor, shutter and mirror sound unobtrusively.

We shot at a dance concert without undue embarrassment, but exercised self-control by waiting for the intermission in order to rewind. Rewinding of DX-coded films is automatic—the mechanism actually counts down automatically and goes into reverse at the proper point. Non-DX coded films are rewound when tension

builds up at the end of the roll; with batteries low, these films may have to be started manually, as mentioned previously. If you want to postpone rewind, just turn the camera off after the last exposure. A 36-exposure roll rewinds in 13 seconds, running the leader back into the cartridge. This is great if you want to prevent inadvertent reloading and reshooting of the roll; bad if you want to change to another film and save the balance of the first roll for later use. Fortunately, the LCD frame counter counts down as the camera rewinds so you can turn the main switch off as you pass frame 1, leaving the film leader exposed for more convenient marking and reloading.

Note that we haven't said anything about setting film speeds. Like most second-generation SLRs and point-and-shooters, Kodak's almost universally used DX bar codes set the film speed and roll length into the XR-M's exposure metering and film advance circuitry through a set of 18 gold-plated contacts in the film chamber. If you shoot reloaded cartridges or have a collection of freeze-dried antique emulsions, you can easily set the ISO speeds manually; but if you want to push or pull film a stop, you must go to the exposure override buttons under the flap at the left end of the camera top plate and key in the modification desired. Since the XR-M's designers have thoughtfully provided an unusual four stops of exposure override, you can do this without using up your normal exposure control override options.

One scratched Kodachrome 200 cartridge produced an ISO 320 setting in error, which we neutralized by adding +.7 EVs (or 2/3 stop, if you prefer) with the override controls.

The ISO set by the DX code flashes briefly as the camera loads itself and then disappears. It can be recalled at will by pushing just the ISO button. DX code settings and the number of exposures on the roll appear on the main LCD and a light-tight inspection window in the camera's back allows the film type, length and speed to be read off the cartridge at any time. A frame counter centered between the film-loading symbols on the body LCD panel reads the number of frames exposed or E for empty.

But that's just the beginning of the body LCD panel functions. You may be familiar with film-loading signals from point-and-shoot cameras, but they are unusual in a camera of the XR-M's calibre. Every stage of your film supply's progress into and through the camera and back into the cartridge is shown in LCD glory. If your film doesn't catch on the take-up spool, the feed spool symbol blinks and the camera refuses to run. Load the film correctly and three dashes flash progressively to show its progress to the take-up spool. It takes about a second for film to wind on to the first exposure. When correctly loaded, you get two spools and a film path with the number of frames exposed indicated in between. Film rewound into the cartridge? E shows that your camera's empty, ready to be reloaded.

Just in front of the LCD, you'll find a three-position selector switch and three



buttons. With the lens diaphragm locked at P and the camera on "Auto," you can select the desired program by sliding this switch left or right. The PA (action) program opens the lens at least one stop, giving a correspondingly high shutter speed to stop motion. Selecting PD (depth) closes the lens at least a stop for more depth of field with a corresponding loss in shutter speed. We say "at least" because the exact amount of change depends on the lens speed, light level and film speed. Because of the wide and easy program choice, it is rarely necessary to go into aperture-preferred or manual modes. The same switch does double duty in the TV mode, selecting speeds accurately timed to match CRT (computer), NTSC (U.S. and Japanese TV) and PAL or SECAM (European TV) scanning rates to avoid scan lines on photos made from television or computer screens.

And how have we been changing these modes? Two small, rather hard-to-press buttons (Ricoh assures us that production models will be softer working) remain in this cluster, just to the right of the shutter release. They change settings continuously when held down and eventually cycle back to the original setting. Using them you can select Automatic, TV or manual modes, set shutter speeds from 1/2000 second to 16 seconds for manual or shutter-biased programmed use and set Ricoh's interval timer/self-timer. More about this novel control later.

What is shutter-biased programmed automation? With PA, P or PD selected, preselect a shutter speed with the increase/decrease buttons and the camera will use that speed as long as lighting conditions permit. If light levels decrease, and the pre-selected speed can no longer be maintained without underexposure, the camera will lower its speeds as necessary, flashing the actual speed set in the finder. When light levels increase, *both* shutter speeds and aperture increase according to the program selected.

At the left end of the camera body, another matching sliding switch selects centerweighted average, auto BLC (backlight compensation), or spot metering patterns for automatic, manual and flash use. In spot, the central portion of the compound SPD sensor in the finder reads four percent of the picture area, corresponding to the rangefinder spot on the focusing screen; in "average" metering the pattern is center-weighted. What is BLC? you might ask. Ricoh's central computer compares its spot and average reading via the algorithm described on page 61 and applies a + or - correction factor varying with light distribution and overall light levels in the scene. Not revolutionary at this stage of the game, but a system foolproof enough to have Ricoh recommend it for general use. In our tests on slide films, results were generally more than satisfactory.

We've left the viewfinder indications to the end; they are most spectacular. But first, a word about the focusing and viewing image. The standard focusing

screen features a diagonal split-image rangefinder approximating the coverage of the meter in spot mode surrounded by a microprism ring and a matte fresnel viewing and focusing area. Alternative screens include Type H, with a horizontal rangefinder with fine fresnel surround; type S, a fine matte fresnel with crosslines; and B, a plain matte fresnel with central microprism circle. They may be substituted at Ricoh service centers for \$40; addresses are listed on the warranty card. The standard screen is amply bright and contrasty for focusing even with relatively slow zoom lenses.

At the bottom of the finder, well clear of the picture area, is an illuminated three-colored LCD readout carrying shutter speed and aperture readouts, exposure and metering mode indicators, flash ready/confirmed symbols and a count-down indicator reading out the last nine frames of DX-coded films. Slow speeds, below 1/60 second, are indicated in yellow, higher speeds in white. Exposure and metering mode settings and a flash charged/exposure confirmed symbol appear

in white on a blue background. Unlike many cameras with programmed exposure automation, the XR-M provides *both* shutter speed and aperture information in the finder in all three program modes. Flick the exposure mode selector back and forth and you can read off your aperture and speed choices in the finder. In aperture-preferred or manual use, the XR-M, unlike the XR-P, forces you to look directly at the lens to see what aperture you've selected. There is no direct-view lens system to transmit aperture ring settings. The loss is minor, considering that you are going to have to take the lens off P and set the diaphragm manually in either aperture-preferred or manual use.

Under low illumination, the whole display is automatically backlit and easy to read and in most outdoor conditions prevailing light does the job. In brightly backlit outdoor conditions, the readouts are sometimes difficult to see even when the illumination is turned on manually by holding down the PV, or preview, button on the mirror box—which also stops the lens down for depth-of-field judgment). In such a situation, grit your teeth and shoot. The camera will do all right without your guidance. Under all other conditions, the display will guide you admirably in making the decisions *you* want to make. By design, the Ricoh XR-M will make the rest.

Ricoh takes all Pentax type K or modified type R-K lenses in its golden contact lens mount. R-K lenses with program settings can be used with all programmed autoexposure settings. Regular Pentax K-mount lenses can be used in aperture-preferred or manual modes. Ricoh, Pentax and independent manufacturers make a wide range of lenses compatible with this mount. In addition, Ricoh offers a P mount adaptor for Pentax and other screw-threaded lenses for aperture-preferred and manual use. The automatic diaphragm does not function and a ballpen must be used to seat the adaptor on the lens. However, it does enable the use of the legions of

screw-thread lenses available in many camera stores.

On the left side of the mirror box, two shallowly inset switches control valuable functions. The lower one, marked PV, stops down the lens for depth-of-field preview in any operating automatic mode or in manual and turns on the viewer illumination as long as it's held down: a commendably direct mode of controlling depth of field—in some cameras you have to come out of automatic mode and first set diaphragms manually. Above it, a matching button, AEL by name, locks spot readings while you recompose a shot. It will hold an exposure indefinitely, even if the camera turns itself off, but is automatically disengaged when you make the exposure, unlike its equivalent on the earlier XR-P. For a series of shots, it's necessary to use exposure override, but this is a clumsier, slower procedure.

This brings us to a set of orange buttons hidden under a flap on top of the left side of the camera. Three octagonal buttons are used in conjunction with the increase/decrease keys near the shutter release. ISO is obvious: press this while operating the increase/decrease keys and you can set any ISO speed from 12 to 6400 for non-DX coded films. Hold down 2 and you can key in up to four stops of over- or underexposure bias in .3 EV increments. A blinking + or - signal in the top LCD and a flashing 2 in the finder remind you that you've taken this liberty. Of course, the shutter speed/aperture finder readouts show you what you're actually shooting at. The remaining button, INT, for interval timing, allows you to program any time interval from one to 3,600 seconds (an hour) into the camera. This can be used three ways: as a time delay or super self-timer waiting as long as an hour before the moment of truth (set motor to single exposure and fire with the self-timer—an orange button at the left side of the body); as an intervalometer to fire shots at pre-selected intervals until the film runs out (set motor to continuous and fire camera with self-timer); and as a timer for bulb exposures up to an hour (set shutter to B, fire with self-timer). Set shutter to B *without* using interval timer, and the LCD display counts *up* in seconds. Set self-timer to 0, and guess what you'll get? A left-hand shutter release with zero delay. When you think about it, it's all very logical and direct. Besides, Ricoh's excellent illustrated instruction book is always there to help.

Thought we forgot the fourth button, a pentagon? The mystic pentagon, when pushed, returns all of the above to their preset positions instantly, or it may be used to reprogram the set points to which the camera always returns when turned on (or when just the reset button is pushed). It is a great convenience when you need to escape from some complex operation to a straightforward shot.

Suppose you're set up to do pictures of your house under construction at one-hour intervals to find out if the workers are doing anything at all, and you've programmed in a +.7 EV exposure correction to compensate for all that white concrete; now somebody drives a dump truck



## 35MM Single Lens Reflex

through your garage door and you need the picture for insurance. Just push "reset" and you're back in control, ready to shoot instantly and set for normal programmed automatic exposure.

You won't find an old-fashioned cable release socket on the XR-M. A standard mini-phone jack accepts the plug of Ricoh's 50cm Electronic Cable Release (\$21) or any other remote release that is suitably equipped.

The already advanced flash system of the XR-P has been made even more convenient with the addition of the featherweight, batteryless Speedlite PX, which clips firmly onto the left side of the body and may be left there virtually unnoticed until you need it.

Working off the four AA batteries that power the XR-M, the tiny flash covers the field of a 35mm lens and produces enough output to reach 20 feet with an f/2 lens. Its guide number is 40 at ISO 100. Exposure is controlled automatically at any aperture selected by the camera's metering system or by the user, with the camera's OTF mirror box-mounted SPD metering cell and circuits. Finder readouts and audible signals keep you informed of flash readiness and exposure sufficiency. Adding a second dedicated flash in the XR-M's prism-mounted accessory shoe permits automated use of two sources; one that can be bounced, while the PX is used direct to fill shadows and add catchlights to the eyes.

In program mode, the camera sets appropriate f/stops (f/2.8 for PA, f/5.6 for P and f/11 for PD) and sets to 1/100 second automatically. The flash terminates when enough light has reached the film plane for correct exposure. The camera's audible signal beeps to indicate sufficient exposure but not for flash recharge. Recharge time varies with battery condition and depth of discharge but is short because of the relatively small output of the PX. Use of wider apertures will extend range, increase battery life and produce a more natural look. Stay with the single-shot mode as the small PX can't keep up with a three-fps motor.

The larger Speedlite 300P, reviewed extensively with the XR-P, has the power reserve to keep up and also fully couples to the XR-M's dedicated functions. Both the PX and the 300P are thyristor-equipped, fully TTL/OTF controlled and can be used in any exposure mode.

Studio flashers will need a hot shoe-to-PC adaptor, since the XR-M lacks a PC connector. Manual use would be dictated in this case.

Using Ricoh's Speedlite PX, the 300 P or the earlier 260P, automatic fill-flash is a snap. Set the camera to program mode, turn on the flash and the shutter sets to 1/100 second. When the flash is charged, the f/stop set is displayed in the finder, and the flash fires at a 1:4 fill ratio with the PX and 1:2 with the 300P for a more natural look. In the finder, the fill-flash symbol is triggered by the metering system at higher light levels, resetting the shutter speeds to 1/100 second and selecting reduced output for fill-flash. At lower light levels, the flash dominates the natural light unless you select a lower shutter speed. If high light levels require a smaller aperture, the camera will set it. With either flash, lower

shutter speeds can be set manually as desired. Higher speed settings will be overridden to 1/100 second, if necessary.

In summary, the XR-M operates as if its flash automation were independent of its continuous light autoexposure systems, which, in fact, it is. But its sophisticated circuitry allows the two systems to work together simply, to the ultimate benefit of the user. It would be hard to find a more simple yet sophisticated camera for flash. Most pros struggle to achieve the fill-flash effects the Ricoh pulls off automatically, yet the system's scope for controlled use is unexcelled.

Accessories include diopter lenses for eyepiece correction available from -4 to +3. The Super Data Back 4 imprints your choice of date and/or time and up to ten alphabetic characters, a set of combining symbols and digits from 0-9 in two lines within the picture area so you can record the date, time and place, note birthdays, etc. It includes additional self-timer, interval timer and very long exposure features and allows selection of the number of exposures to be made in a sequence. Nope, it doesn't bracket exposures. The simpler Data Back 3 can be used as a digital watch and records month and date or hour and minute on the film, varying its exposure automatically to suit the speed of the film you're using.

To wrap up this rather remarkable electro-mechanical package, we'd like to congratulate Ricoh's engineers for producing a simple-to-use SLR that can be operated with pleasure by any point-and-shooter while offering exceptional versatility that the most proficient user is unlikely to outgrow. If you've been looking for the convenience and flexibility of the latest second-generation autofocus SLRs but don't need or want autofocus, the XR-M will give you everything you're looking for.

## SNAPPY RIKENON 50mm f/1.4

**Specifications:** 50mm f/1.4 Rikenon P, No. 103586 in Ricoh K-mount, f/1.4 to f/16 plus locking P setting with full stop detents; min. foc. dist. 1.5 ft. (0.45m) with 120 (degree) clockwise turn; accepts 52mm accessories; 7 elements in 6 groups; 1 5/8 x 2 1/2 in. (40 x 63mm) 5 1/16 oz. (146g). List price: \$188.

**Comments:** Matte black finish with 1/2 inch textured rubber focusing grip at front, footage scale in yellow, metric in white, rear-mounted knurled aperture setting grip, depth of field scale, infrared focusing index, release button for setting or releasing P settings (for programmed, manual or aperture-preferred use), white raised dot for easy lens insertion into mount bayonet.

**Field test slides:** Our transparencies were crisp and snappy at all apertures. Very slight color fringing seen at full aperture in corners, almost gone by f/4. Corner sharpness equalled center by f/5.6. Slight falloff wide open was gone by f/2. In extreme backlighting, flare could

lower contrast if lens used at wide apertures. Overall, performance was average for a fast normal lens.

**Optical bench analysis:** On-axis, very slight over-corrected spherical aberration, with very slight red flare was seen, disappeared by f/4. Performance was diffraction limited by f/8.

Off-axis, very slight skew ray flare mixed with astigmatism was seen, almost gone by f/11. Some lateral color was seen.

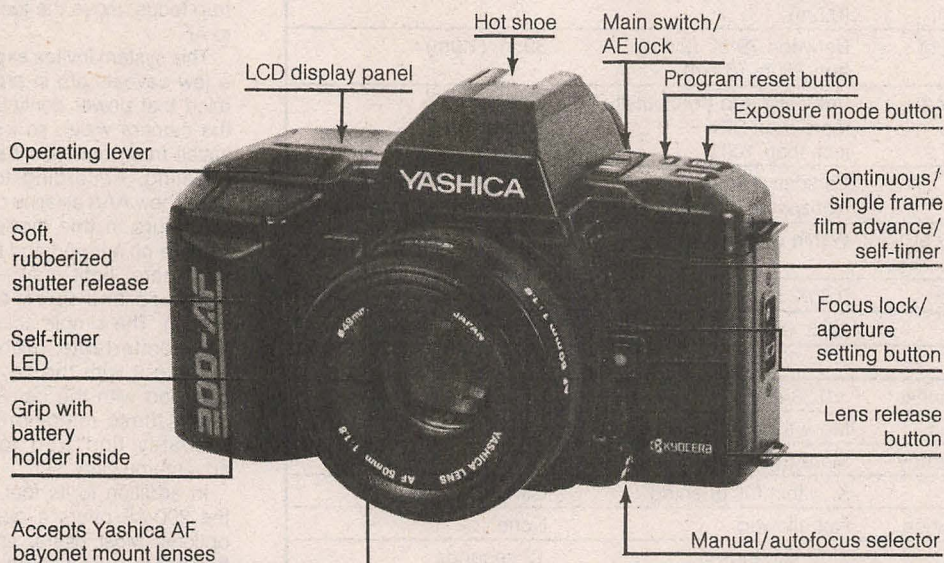
## YASHICA 200-AF SLR WITH EASE

**MANUFACTURERS SPECIFICATIONS:** Yashica 200-AF 35mm single-lens reflex, body No. 0216058. **LENS:** 50mm f/1.8 Yashica AF No. F2023539 in Yashica AF mount. **SHUTTER:** Vertical-travel metal-bladed focal plane, with speeds from 8 seconds to 1/2000 in all modes, plus B in manual mode, 1/90 second flash sync. **FILM ADVANCE:** Motor driven, with single-frame and continuous modes, up to 1.7 frames per second. Auto loading; electric rewind. **EXPOSURE SYSTEM:** Program AE, aperture-priority AE, shutter-priority AE, non-metered manual. Dual programs (85mm and below; 86mm and above); program shift; exposure lock. User-set values in aperture-and shutter-priority AE modes are automatically overridden to prevent under- or overexposure. One SPD cell reads center-weighted average pattern for ambient-light exposure. EV 1-20 (at ISO 100, with f/1.8 lens). ISO 25-5000 for DX-coded film, ISO 100 for non-coded film. **AUTOFOCUS:** Focus-priority (single shot) or continuous (servo) AF using TTL phase detection with CCD sensor in bottom of mirror box. AF range EV 2-20. Trap-focus mode. Manual focusing also possible. **FLASH:** Six-pin dedicated hot shoe. Flashmatic system sets lens aperture automatically, according to AF distance, when used with CS-140 or CS-250AF dedicated flash units. Sync speed of 1/90 second set automatically for all AE modes. In manual mode, 1/90 second set if camera set to 1/90 or faster; slower speeds remain as set. **VIEWFINDER:** Non-interchangeable eye-level prism. Standard screen has AF bracket, full-area focusing. Three other screens available. **OTHER FEATURES:** LCD panel on body indicates film status, frames exposed, battery condition, exposure mode, film-advance mode, focus mode, shutter speed, lens aperture, self timer, ISO film speed, rewind, flash status. Cancellable, electronic ten-second self-timer with audible and visual indicators. Film-identification window on camera back. Reset button returns focus, exposure, and film-advance modes to preset values. Release socket for remote-control units. Tripod socket. **BATTERIES:** Four AAA batteries or one six-volt 2CR5 lithium battery in removable handgrip. **PRICE:** Body, \$445; 50mm f/1.8 lens, \$120; CS-140 flash, \$35.

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## What's New at a Glance: Yashica 200 AF



With the 200-AF, Yashica has produced a multi-mode autofocus SLR that's easy for beginners to master quickly, yet versatile enough to please many advanced amateurs. In order to create this lower-priced version of the 230-AF (tested in our April, 1987 issue), Yashica has eliminated a few of the 230's significant features, but given the 200 several interesting touches.

Gone on the 200 are OTF flash metering, exposure-bias control, manual ISO film-speed settings, manual exposure metering, viewfinder f/stop and shutter-speed display, a 16-second shutter speed and the ability to use the CS-110AF slide-on flash unit. On the plus side, the 200-AF has larger, simpler controls, a more rounded, more comfortable body and an intriguing and effective flash system of its own.

To power up the 200-AF, loosen a slotted screw in the handgrip and remove it from the camera. Inside the grip is a removable compartment that holds four AAA batteries. Although a label in the grip of our model advises the use of alkaline cells only, the grip will also accept a six-volt 2CR5 lithium battery (without the AAA battery holder in place, of course). It's reassuring to have the choice of long-life lithium power or ubiquitous AAA batteries, and the instruction manual endorses both alternatives. (By the way, the battery compartments of the 200-AF and 230-AF are interchangeable, which could lead to some confusion for two Yashica camera households, as each camera's model number is boldly displayed on its grip.)

Film loading is extremely easy: Firmly push the cartridge into place, place the film tongue under an orange bar, close the back and the film is transported automatically to the first frame. If you somehow load the film incorrectly, the frame counter will remain at zero instead of registering the first frame. DX-coded film

speeds over a range of ISO 25-5000 are set automatically; non-DX cassettes key in a setting of ISO 100.

After the film is loaded, its ISO is displayed momentarily on the 200-AF's multi-purpose LCD panel. To identify an already-loaded cassette, just check the window on the camera back.

Four major controls are located on the left side of the top deck. A grooved three-position switch (larger and easier to use than its counterpart on the 230-AF) turns the 200-AF on and off, and activates the AE-lock mode. This mode lets the camera "memorize" the f/stop and shutter-speed settings as you touch the shutter-release button so you can recompose without losing the settings.

Also on the left side of the top deck is a rectangular button marked "drive," which works in conjunction with a curved slider switch on the right side of the deck. Turn on the camera for the first time and the letters "S" and "AF" appear on the LCD display, letting you know that the camera is set for single-frame film advance and "one-shot" (or focus priority) AF operation. To change these settings, hold down the drive button and push the slider, which changes the display to "C" (continuous film advance) and "CAF" (continuous, or servo, AF). Another push reveals a clock symbol, indicating self-timer operation. Your choice of single-frame or continuous advance (but not self-timer) is retained even when you switch the camera off.

Next to the drive button is the exposure mode control, which works in a similar way to the slider switch that controls focus modes. Your exposure choices—displayed on the LCD—are "Program" AE, "TV" (for "time value" or shutter-priority AE) "AV" ("aperture value" or aperture-priority AE) and "M" (manual exposure). We'll discuss these exposure options a bit later on. The 200-AF's control layout is

extremely clear, but if you do get confused a quick push on the convenient "P" button (located next to the drive button) restores the camera to its standard single-frame, one-shot AF and program AE settings.

The LCD panel gives a complete readout of camera functions: exposure, film-advance and AF modes; and the f/stop, shutter-speed and frame number are always visible as well. At appropriate times, the display also shows symbols for film status, rewind, flash ready and low battery power. In the "bulb" setting (manual time exposures), it shows the time elapsed up to 59 seconds.

One feature of the LCD that takes a little getting used to is its eagerness to turn itself off. Immediately after you take a picture, or about eight seconds after you touch the shutter-release button, the display goes blank. To maintain the display, you have to keep your finger on the shutter release button (or put your finger back on the button), which is okay most of the time but can be rather inconvenient for tripod work. We understand the need to minimize battery drain, but a 20- or 30-second cycle would make shooting a bit more relaxed and comfortable. Next to the LCD panel is the rounded, grooved slider switch used to change drive, mode and other settings. In front of that is the very comfortable, rubberized shutter release button. Your pointer finger falls naturally on the release button as you grab the nicely curved handgrip, and your thumb hugs the molded rest area on the camera back. (This is another subtle improvement over the 230-AF.)

Several controls are designed for use by your left hand. At the bottom of the camera front is a rounded lever that chooses AF or manual-focus operation. Because it's small, curved and smoothly finished, this lever can sometimes be hard to



## 35MM Single Lens Reflex

### GENERAL PERFORMANCE

| Checkpoints                           | Our Standard                                                                                                                                                                        | As Tested                                        |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <b>FINDER:</b>                        |                                                                                                                                                                                     |                                                  |
| Apparent viewing distance             | Between infinity and 20 in. (0.5m)                                                                                                                                                  | 39 in. (1.0m)                                    |
| Apparent distance of LED display      | Between 79 in. (2.0m) and 26 in. (0.7m)                                                                                                                                             | 39 in. (1.0m)                                    |
| View area compared to film area       | Vertically and horizontally more than 90%, less than 100%                                                                                                                           | Vertical: 93%<br>Horizontal: 93%                 |
| Parallax error compared to film       | Vertical: 0.8mm<br>Horizontal: 1.3mm                                                                                                                                                | Vertical: 0.2mm (up)<br>Horizontal: 0.4mm (left) |
| Focusing accuracy at maximum aperture | Within depth of focus                                                                                                                                                               | No Discrepancy                                   |
| Image magnification                   | 0.80X $\pm$ .1X                                                                                                                                                                     | 0.81X                                            |
| <b>PICTURE SIZE:</b>                  | 24 $\pm$ 0.6mm x 36 $\pm$ 0.9mm                                                                                                                                                     | 23.9mm x 36.1mm                                  |
| <b>SHUTTER:</b>                       |                                                                                                                                                                                     |                                                  |
| Curtain travel evenness               | $\pm$ 0.33 stop                                                                                                                                                                     | -0.2 stop                                        |
| Insulation from sync                  | More than 7 megohms                                                                                                                                                                 | Infinity                                         |
| Sync contact efficiency               | More than 60%                                                                                                                                                                       | 72%                                              |
| Sync delay time                       | X: within full opening                                                                                                                                                              | Okay                                             |
| Shutter curtain bounce                | Not allowed                                                                                                                                                                         | None                                             |
| Self timer delay                      | 7-15 seconds                                                                                                                                                                        | 12 seconds                                       |
| <b>CAMERA NOISE:</b>                  | 75 dB(a), average for a motorized SLR                                                                                                                                               |                                                  |
| <b>CAMERA SIZE:</b>                   | Body: 5 $\frac{1}{4}$ in. wide x 3 $\frac{3}{16}$ in. high x 2 $\frac{3}{8}$ in. deep (148 x 90 x 61mm)<br>Lens: 1 $\frac{1}{2}$ in. long, 2 $\frac{1}{2}$ in. diameter (36 x 64mm) |                                                  |
| <b>WEIGHT:</b>                        | Body: 1 lb. 5 $\frac{3}{8}$ oz. (606g) with batteries<br>Lens: 5 $\frac{1}{4}$ oz. (149g)                                                                                           |                                                  |

manipulate. We had no such problem with the rectangular lens-mount-release plunger, or the aperture-selector button above it. Yashica AF lenses do not have f/stop rings, so you press this button and push the slider switch to change apertures in manual-exposure mode. Unlike the 230-AF, the 200-AF's metering system does not operate when you set exposures manually.

The 200-AF has four focusing modes. The first three are pretty straightforward, but the fourth is rather exotic.

Single (or focus-priority) AF means that the autofocus system looks for and locks on a subject—and only then lets you take a picture. To activate this mode, simply press lightly on the shutter-release button. When proper focus is achieved, a ball-shaped LED in the viewfinder lights up and a beeper sounds. This focus setting is held until you either remove your finger from the button or push it all the way and take a picture. Because it locks the focus in this convenient way, single-shot AF is a good choice for dealing with non-centered subjects. In fact, many photographers prefer this mode for all stationary subjects—centered or not—because it avoids wasting film on fuzzy pictures.

With a moving subject, the continuous (or servo) AF mode is appropriate. In this mode the AF system keeps seeking correct focus for as long as you lightly press the shutter-release button. More pressure on the release trips the shutter, whether or not the focus is perfect. The 200-AF will continue to fire at that focus setting until you stop pressing the button. The ball symbol lights up to show proper focus, but in this mode the exposure-confirmation beeper does not sound.

Manual focus operates just as you would expect. First move the focus-mode lever on the camera body to its "MF" position, then focus via a rather skinny knurled ring near the front of the lens. The standard focusing screen does not have any focusing aids, but the contrasty ground-glass image allows comfortable focusing in bright light, even with a relatively slow lens, such as the 35-70mm f/3.3-4.5 zoom.

The viewfinder ball lights up to confirm manual focus when the AF sensor can "see" that focus has been achieved. However, you'll probably be using manual focus in low-light or low-contrast situations where the AF system can't cope, therefore the focus-confirmation won't work either. (If you anticipate a lot of manual focusing, you might opt for the accessory FA-4 focusing screen, which contains a split-image rangefinder with a microprism collar.)

Finally we come to the "trap focus" mode pioneered on the 230-AF. This unusual system employs a combination of manual focusing and AF sensing to give you sharp remote-control pictures. Here's how it works: First set the focus switch to "MF" for manual focus. Next, press in the drive button and push the slider switch until the letter "C" and a four-diamond symbol are visible on the LCD. Then put your camera on a tripod or other support and set any exposure mode you choose. Compose and focus manually at a desired distance, making sure there is no in-focus subject at that distance in the center of the frame. Finally, press the shutter button and lock it in with a cable release. Now your 200-AF is ready and waiting for a subject to arrive at the prefocused distance in the

center of the frame. And when that happens, the camera will automatically start firing. It will continue to shoot until the subject leaves the sensing area or moves out of focus. (You may—in these circumstances—run out of film!) To cancel trap focus, move the focus-mode selector to AF.

This system invites experimentation, but a few caveats are in order. First, keep in mind that power continues to drain while the camera waits, so it's a good idea to install fresh batteries before you go trap shooting. According to the instruction book, new AAA alkaline cells will last about ten hours in this mode. Also, with the camera on a tripod and the user stationed elsewhere, light may enter through the eyepiece and throw off the exposure system. The simple solution is to remove the comfortable rubber eyecup and replace it with the "eyepiece shutter," supplied with the camera. Once you've taken these minor precautions, you'll probably find trap focusing a lot of adventurous fun.

In addition to its four focusing modes, the 200-AF offers a quartet of exposure options. Most users, and certainly most beginners, will be attracted to the program AE system, which sets both aperture and shutter speed according to light conditions, the ISO film speed in use and the focal length of the lens. (There are actually two programs here—one for focal lengths of 85mm or less and another for longer lenses. Over most of its range, the long-lens program chooses shutter speeds about 1.5 EV higher than the "standard" one, and correspondingly wider apertures. The total amount of exposure is identical in either case. With a zoom lens in place, the program is set according to the focal length being used.)

You can also shift the values of the program manually by pushing the slider switch in either direction. The amount of shift possible is about 1.5 EV each way (that is, toward faster or slower shutter speeds), with the total amount of exposure again unchanged.

When you shift the program, the "program" indicator on the LCD flashes, and the f/stop and shutter-speed numbers change accordingly. The "P" symbol in the viewfinder also blinks, but because there are no f/stop or shutter-speed indications in the finder, it's difficult to take full advantage of the program shift without taking your eye from the finder and looking at the LCD panel to read the f/stop and shutter-speed settings. When you take a picture, the program shift is cancelled.

For photographers eager to try a little more manual input, both aperture- and shutter-priority AE are available. With these modes, you set the f/stop or the shutter speed, respectively, and the camera does the rest. Even here, the 200-AF is designed to protect the novice. In either priority mode, if your setting will lead to under- or overexposure, the camera simply overrides it. Let's say you have the shutter set at 1/2000 second in the TV mode to photograph race cars. You track one of the cars into the shade, which might cause underexposure at 1/2000 even with the lens wide open. So the 200-AF pulls the shutter speed down to 1/1000 or 1/500 (or whatever is necessary) to make a



correct exposure. Depending on the specific situation, you might end up with a fine picture or the proverbial "well-exposed blur."

The final exposure mode is full manual control. In order to adjust the f/stop in this mode, depress the manual-aperture button on the camera front and push the slider switch. To change shutter speeds, move the slider *without* holding in the aperture button. A full range of electronically timed speeds is available, from eight seconds to 1/2000 second. We suggest that you plan to use a separate lightmeter, however, because the 200-AF gives no exposure guidance in the manual mode.

Like several other recently-introduced SLRs, the 200-AF presents viewfinder information in the form of LED symbols. In addition to the two already mentioned (P for program and the focus-confirmation ball), there's a triangle that lights up to warn of shutter speeds of 1/30 second or slower in any AE mode, and a lightning-bolt flash-ready symbol. The trade-off here is a simple viewfinder display that's inexpensive to make and less intimidating; but advanced photographers who like to fiddle with settings will have to take their eyes from the finder to check the numbers.

Although the 200-AF does not have OTF flash metering, it does offer a very effective alternative. Attach a dedicated flash, such as the CS-250AF or the compact new CS-140 and the camera's "CPU-matic" system performs a sophisticated version of the old "flashmatic" exposure method; the AF system determines the subject distance, then automatically sets the right f/stop for flash. If you'd rather focus manually, the CPU-matic will set the

aperture according to the distance you've chosen.

The shutter speed is automatically set to the flash-sync value of 1/90 second, even if you've inadvertently set a faster speed. (A nice touch is that in the manual-exposure mode, you can set slower speeds for flash/ambient light balancing.) Unlike most automatic flash units, the CS-250AF and CS-140 always fire at full power. Although this system uses more flash-battery power, it offers the advantage of choosing suitably small f/stops with close-up subjects, where you really need the depth of field.

The very small, sleek CS-140 flash is a particular pleasure to use. It slips into the camera's hot shoe and is so light (3 1/2 ounces with two AA batteries) that you'll probably just leave it there. To turn it on, pull up on the front of the unit until you hear (and feel) a click. When the flash is ready, a light glows on its top and the lightning-bolt LED in the finder lights up. If the lightning bolt blinks, you're too close or too far from the subject for proper flash exposure. The pull-up design of the CS-140 moves the flash reflector almost four inches above the center of the lens to help minimize red eye. In addition to dedicated flash units, a full range of lenses, interchangeable focusing screens and a data back are also available.

The Yashica 200-AF, with its variety of operating modes and automatic features, should prove attractive to photographers who want to combine the versatility of an SLR and the ease of a point-and-shoot camera. Essentially a streamlined version of the 230-AF, the 200 maintains many of the earlier model's attractive features—especially the unique trap-focus mode.

## 50mm f/1.8 AF LENS FROM YASHICA

**Specifications:** 50mm f/1.8 AF Yashica No.F6200257: in Yashica AF bayonet mount, accepts 49mm accessories; f/1.8 to 22 set electronically by camera; minimum focusing distance: one foot, six inches (0.45M); built-in retractable lens shade; 1 1/2 inches x 2 5/8 inches diameter (38x67mm); 7 ounces (99g). \$110.

**Practical comments:** Excellent satin black finish, narrow texture grip, narrow beveled, ribbed focusing ring. Distance scales clearly visible in window with feet in orange, meters in white. Depth-of-field scale plus IR focus mark on window. Lens focuses from infinity to minimum distance in 0.85 second

**Field test slides:** Our Kodachrome 64 transparencies were well exposed, crisp and snappy. A slight softness could be detected in the extreme corners of these slides taken at f/1.8. Flare was well controlled throughout. Performance was judged average to above-average for a normal lens.

**Optical bench analysis:** On axis, very slight over-corrected spherical aberration mixed with very slight red flare. Both gone by f/4. Diffraction limit was reached by f/11. Off axis, very slight skew-ray flare mixed with slight astigmatism, almost gone by f/16. Slight lateral color was present.

# 35mm NON-REFLEX

## PENTAX IQZOOM: FIRST POINT-AND-SHOOT 35 WITH BUILT-IN ZOOM

**MANUFACTURER'S SPECIFICATIONS:** Pentax IQZoom autofocus 35mm leaf-shutter camera. Body No.4890736. **LENS:** 35-70mm f/3.5-6.7 Pentax Tele-Macro, focusing to 3.3 ft. (1m) in normal mode, to 2 ft. (0.6m) in "macro" mode, power zoom control. **SHUTTER:** Programmed AE, between-lens leaf with speeds of approx. 1/40-1/250 sec., electromagnet release. **VIEWING:** Inverse Galilean zoom finder with Albada-type bright frame, parallax compensation marks, central autofocus frame. Auto-parallax compensation by prism at "macro" setting. **Magnification:** 0.35X at 35mm, 0.64X at 70mm. **EXPOSURE SETTING:** External CdS cell controls programmed autoexposure from EV 9-15 at 35mm setting, from EV 11-17 at 70mm and "macro" settings at ISO/ASA 100, DX auto film speed settings from

ISO/ASA 50-1600. **AUTOFOCUS SYSTEM:** Pentax, active infrared AF system provides 18 focusing steps from 3.3 to approximately 40 ft. In normal range, 17 steps from 3.3-2 ft. in "macro" range. **FLASH SYSTEM:** Built-in, sensor type, zoom autofocus with provision for daylight synchro flash. **OTHER FEATURES:** Focus lock via shutter button, focus OK and flash recycle LEDs, +2 stop back-light compensation control, autoloading, autowinding, auto-rewind with mid-roll rewind provision, built-in 10-sec. self-timer with LED, LCD panel with frame counter, film wind OK signal and battery check; built-in lens protector. **POWER:** One 6-volt lithium or four alkaline AAA cells. **PRICE:** \$385.

Eleven short years and a technological generation ago, Konica brought forth the first autofocus still camera—the C35AF. Like the legions of imitators and refiners that followed, it sported a semi-wide-angle lens and a built-in autofocus. Not too long afterward, Canon and many others added autowind, rewind, and loading to the feature

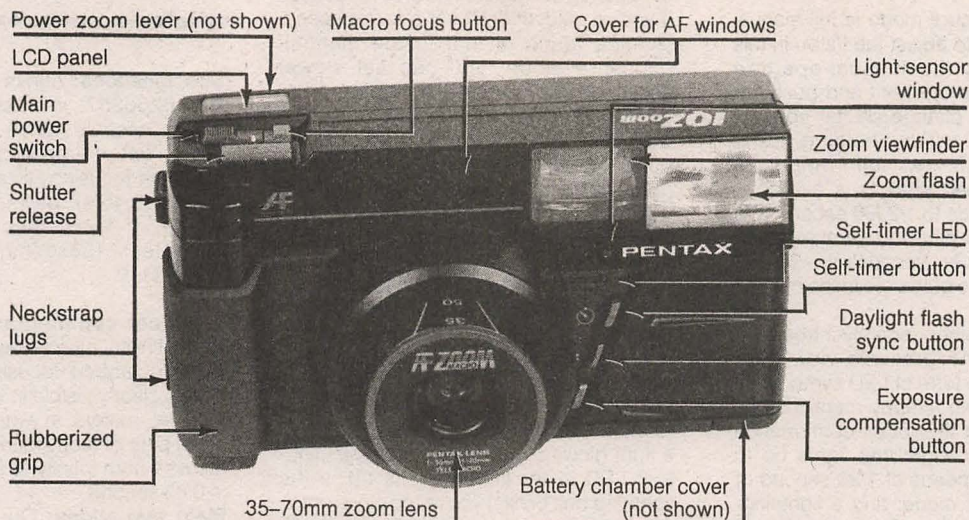
mix, and by the time DX auto-film speed setting arrived, virtually every major Japanese camera manufacturer was offering an "auto-everything" autofocus (AF) leaf shutter 35. Indeed, for the past half dozen years, point-and-shoot, nonSLR 35s have comprised the fastest growing sector of the photographic equipment market.

Not surprisingly, the fierce competition among makers of what the Japanese call lens-shutter AF 35s has resulted in a kind of technological horsepower race in the point-and-shoot arena. Such exotica as sensor flash (which fires when needed), lithium battery power (which provides rapid flash recycling, long storage life, and vastly improved cold weather performance), full-information LCD panels and weatherproof bodies have become commonplace. Many makers of AF cameras have increased the number of AF zones, leading to improved sharpness and closer focusing distances. Even once-separate accessories such as tele and close-up or macro attachments have now been cleverly integrated into many of these fully automatic "you press the button" machines. Consumers now have a choice of over a dozen "dual lens" or "tele-wide" AF 35s plus scores of one-lens models.

Although Pentax joined every other major and minor camera maker in carving out a fair share of the point-and-shoot pie (with worthy and successful contenders such as the PC35AF and the Sport), Pentax wisely decided not to bring out yet another dual-lens AF 35 to compete with the dozen or so al-



## What's New At A Glance: Pentax IQZoom



ready on the market. Realizing that the on-going dollar-yen squeeze would bring the prices of most dual-lens AFs perilously close to those of moderately priced, automatic, non-AF SLRs, and foreseeing a saturated "mass market" for dual-lens 35s, Pentax decided to do something different and truly audacious: to take two of the most popular features found in today's sophisticated cameras—autofocus and the zoom lens—and combine them in a single, reasonably compact, auto-everything 35. The result is the Pentax IQZoom, the world's first non-SLR 35 of any kind with a built-in zoom lens!

Technically, the IQ is a remarkable achievement. Simply getting a good-performing, 35–70mm f/3.5–6.7 to function within the nearly pocketable confines of a medium-sized AF 35 is no mean trick. To integrate a zoom lens masterfully into an auto-everything camera that incorporates virtually all the latest bells and whistles plus power zooming, zoom flash, and "macro" mode with auto-parallax compensation is nothing short of sensational.

At first glance the Pentax IQ gives scarcely a hint that it's anything unusual, much less extraordinary. Its styling is rather conservative, in the contemporary squared-off mode, and it's about the same size and weight as the average dual-lens AF 35, which is somewhat wider, deeper and heavier than current one-lens models. On its right-hand side is the almost obligatory built-in grip with its grippy rubberized surface in gray. The red rectangular shutter release perches conveniently atop the grip in a little recess in the top plate, and the viewfinder and flash are where you'd expect to find them. The body is nicely satin-finished, black polycarbonate and the dark translucent panel over the AF windows enhances the IQ's clean lines. Only the word "ZOOM" on the lens surround and top, and the sliding power zoom switch above the right-hand thumb rest on the back of the camera give any hint of its extended optical capabilities.

Before the IQ will reveal its brilliance you must slide, then flip open the battery compartment on the left-hand end of its bottom plate and insert either a 6-volt lithium battery

or four alkaline AAAs. There are polarity indications and a diagram on the gray plastic inner frame that holds the AAAs, and a warning not to use nicads. To check battery condition, slide the gray main power switch behind the shutter release from the circle mark (closed) to the line mark (open). If you've got sufficient power, the two-bladed protector in front of the lens will open and the lens will move forward about 1mm to the whirl of the zooming motor. At this point, the lens will automatically be set at the 35mm position.

To load the camera you need not turn it on. Just push the locking tab on the left-hand side of the back downward in the direction of the "Pacman" symbol and swing the hinged back open to the right. Now hook the recessed end of the 35mm cartridge over the rewind shaft in the cartridge compartment on the right (there's a diagram to show you how) and pull the film leader to the left until it reaches the orange film mark to the left of the rubber-clad take-up shaft. Make sure that the film lies reasonably flat, and that the tangs on the upper end of the take-up shaft protrude through sprocket holes in the leader. Then snap the back shut. If all is well, the film-wind motor will whirl and the LCD panel atop the camera behind the main power switch will display a cartridge with film winding out of it and stop when number 1 appears. The LCD serves as an additive film counter, counts down as the film is rewound, and displays battery condition warnings. When you partially depress the shutter release and a battery symbol appears, you can shoot another roll or two; when the battery symbol flashes on its own, battery exhaustion is imminent.

In the cartridge compartment are four pairs of gold-plated DX contacts, which will key in film speeds from 50–1600. Non-DX film will automatically be keyed in at ISO/ASA 100. The LCD panel will not tell you what speed has been keyed in, but there is a cartridge ID window in the lower part of the thumb rest on the back to let you know (in most cases) what kind of film is loaded.

Now comes the fun part. Turn on the main power switch, bring your eye up to the finder

eyepiece, place your right-hand thumb on the sliding, spring-loaded zoom control tab at the upper right-hand corner of the camera back and push and hold it to the right toward the T (tele) mark. The zooming motor whirs, and in little over a second the front of the lens extends nearly an inch as it reaches 70mm tele position and stops. Naturally, the viewing image in the direct optical finder zooms right along with it. Push and hold the zoom control toward the W (wide) mark on the left and it'll zoom back to the 35mm position and stop. Needless to say, you can release pressure on the zoom control at any time if you wish to set intermediate focal lengths. There are 35, 50, and 70mm focal length indications on the top of the lens barrel, but in most cases you just frame your subject in the finder and zoom back and forth until you get the composition you want. No matter what focal length or mode you're zoomed to, the instant you turn the main power switch to "closed" position, the lens will zoom back to 35mm position and the lens protector will close.

As long as we're peering through the finder let's take a closer look at it. In its center you'll find the typical autofocus frame, which is nearly square. Around the periphery are the main outer field frame, which is rectangular with rounded corners, and three inner parallax compensation lines that define a smaller rectangle within the main frame. This inner frame is used as a guide when shooting at about 3.3 ft. in the normal mode or at close distances (down to 2 ft.) in the "macro" mode. All framelines appear in bright yellow, but they're reflected into the finder (using the Van Albada system) rather than projected with a separate illuminator panel, so they tend to disappear in low light or under contrast illumination. Also, while parallax compensation marks certainly help you compose more accurately, they are not nearly as precise as moving framelines that automatically compensate for parallax as you focus (à la M-series Leicas). Partially to offset this problem, the area defined by the IQ's framelines covers only about 82% of what you get on film. This compares to about 92% for the average SLR.



While the Pentax's finder is no match for an SLR's or a Leica's it is bright, clear and useable—certainly equal to those found in many other AF 35s. If it's smallish and the entire frameline isn't quite visible to eyeglass wearers, that's because engineering a true zoom finder into a reasonably compact, full-featured AF 35 is incredibly difficult. It's a tribute to Pentax's designers that the IQ's finder is one of the few places where engineering compromises are clearly evident.

One important area where the IQ lives up to its name is the built-in zoom flash, which is brilliantly executed. Yes, it zooms as the lens and finder zoom to provide efficient coverage at all focal lengths, and it does so by moving the flash head internally rather than by extending the flash optics. The flash's front panel is inscribed with a Fresnel pattern to help direct the light. The flash head moves closer to the front panel as you move toward the wide-angle settings to provide a broader beam, farther back to provide a narrower beam at tele settings, and forward again when you select "macro" range, which again requires a wider flash angle. The result of this ingenuity: a flash that provides, with only rare exceptions, accurate autoflash exposures and pleasant lighting over the IQ's extremely wide focal length and distance range.

As you might expect, the IQZoom's built-in flash is quite efficient, providing maximum shooting distances of 16.4 ft. at 35mm, and 10.4 ft. at 70mm with ISO/ASA 100 film. The shorter distance at the longer focal length is due, of course, to the smaller maximum aperture, which is f/6.7 at 70mm. If you need longer autoflash distances, simply select a faster film. With ISO/ASA 400 film, maximum shooting distances are 32.8 ft. and 22 ft. respectively. There's no need to worry about underexposing your flash pictures when you shoot slower films. When you've loaded up with 50, 100 or 200 speed film, the green focus confirmation light in the eyepiece bezel will flash if you try to exceed the autoflash range, warning you not to take the shot.

All right, let's take some pictures. We'll presume our IQ is loaded and that the main power switch is turned on. To focus, bring the camera to eye level, place the central autofocus frame over that part of the main subject you want sharp and press the shutter release partway in until you feel slight pressure. If the camera can achieve proper focus, the easily visible green LED just to the left of the top of the finder eyepiece lights up continuously.

To take the shot, press the very smooth, comfortable release all the way in and the shutter fires with a long, low-pitched click, the film immediately winds to the next frame in about a second with a higher-pitched whir, and the frame counter in the LCD panel advances one digit and displays film advance graphics. If you don't want to place the main subject in the center of the frame, or you wish to lock the focus in at some specific distance (for example, when there's a distant object in between two subjects), press the release partway in to focus, hold it in as you recompose, and follow through with your shutter release finger to take the shot. This is the same procedure used with most late model AF 35s.

When the camera can't focus, the green LED pulses in warning, but you can still fire the shutter if you're in the normal focusing mode (3.3 ft. to infinity). The green LED will

blink if you're too close, so back up beyond the minimum distance and try again.

As the concise, generally well-written instruction booklet confesses, the infrared autofocus system in the IQ "is not almighty and may not properly focus on certain subjects." As with similar AF cameras from other makers, the system can be fooled by very dark, flickering, finely patterned, and highly reflective subjects as well as "formless" ones like water jets and fireworks. The solution: Lock focus on a surrogate subject located at about the same distance as your intended one, recompose and take the shot. In general, we found the IQ's autofocus performance to be very good, with perhaps one or two misfocused pictures per 36-exposure roll. This is about what you can expect with current dual-lens AF 35s from other major makers. The IQ-Zoom is better than most in providing ample warning when it can't focus properly, but this cuts two ways. In our test camera, occasionally the green LED would blink for no apparent reason even though we had a clearly defined, non-problem subject well within the focusing range. When we let go and touched the release again without moving the camera we would usually get focus confirmation. All pictures we shot under such conditions were sharp.

Depress the shutter button partway in a relatively dark place (below EV 9 at ISO/ASA 100) and the IQ automatically switches to autoflash mode. The red flash-recycle LED below the green focus OK LED (both are clearly visible with your eye up at the eyepiece) flickers as the flash is being charged. If you try to take a picture while the red LED blinks, the shutter won't fire—you must release and redepress the button once the flickering stops, which only takes about 2 sec. with a fresh lithium battery, about twice as long with alkaline AAAs. Once it's charged the flash will stay charged for quite a while, so you can pre-charge it if you anticipate grab shooting in low light. Also, once you shoot a flash picture, the flash will automatically recharge itself for the next one even if you don't maintain pressure on the release.

The IQ is also capable of daylight-synchro flash when, for example, you want to fill in harsh shadows with a backlit or sidelit subject. To fire the flash under bright light conditions, press the shutter button partway while pushing in the daylight-sync button to the left of the "lens barrel," the one denoted by a lightning bolt. Wait until the recycle LED lights to take the shot. Since the programmed autoexposure system is still operational, the effect of daylight-synch flash depends upon the ambient light level and the camera-to-subject distance. It's most effective at relatively close distances and/or medium light levels.

Without doubt, one of the IQ's most appreciated features will be its "macro" shooting ability. Granted, this is not the true macro range possible with SLRs, but at the 70mm "macro" setting, the IQ's 2 ft. minimum distance works out to 1/8 lifesize, close enough for a frame-filling head shot of a young child. To select "macro" range (2–3.3 ft.), press in the stepped green macro button behind the shutter release and move the main power switch over its lower step until its index line coincides with the green index line for the "green flower" macro symbol. The instant you do so, the lens protector opens, the lens zooms out to 70mm (Yes, there's a little

green flower next to the 70mm mark on the lens barrel!), and a parallax-compensating prism with a translucent green border comes into position behind the front glass of the finder to warn you that you're in "macro" range.

Before you take a "macro" shot, press the shutter release partway in. If you're too close or too far for "macro" shooting, or if the camera can't focus, the green focus OK LED will flicker and the shutter release will lock. Move the camera closer or farther away if you're out of range, or focus on a substitute subject until you get the LED to light continuously, then recompose and take the shot. The red flash-ready LED works the same in "macro" as in the normal shooting range.

Shooting really close close-ups with the IQ is very easy, extremely enjoyable and the results are often amazingly good, rivaling the pictures obtainable with a fancy SLR and a macro zoom lens. Framing cannot be as precise, however. Even though the ingenious slide-in corrector prism provides true autoperallax compensation, it does so for only one distance near the midpoint of the "macro" focusing range. The picture area at this distance is indicated by the parallax correction marks in the finder. The instruction book provides a guide for shooting at the minimum 2 ft. distance, and most other framing errors will be obviated by the fact that the finder shows about 18% less than you'll get on film.

As long as we've mentioned the IQ's autoexposure system, herewith some good and bad news about it. Its overall field performance was exemplary, even when we shot Kodachrome 64 (our official test film, which has a much narrower exposure latitude than the color negative films for which cameras of this type are primarily intended). On the down side, it is possible to overexpose pictures shot with fast film in bright sunlight, particularly at the widest-angle settings with slide film. At 35mm, the IQ's exposure range only gets up to EV 15 at ISO/ASA 100, equivalent to a cloudy-bright day. The danger is less at the 70mm setting, where it gets to EV 17. With the vast overexposure latitude of today's color negative films this shouldn't pose too many problems. Still, we wouldn't load up with film faster than ISO/ASA 400 if we intended to shoot in bright sunlight.

A theoretical snag is the meter cell's fixed 30° acceptance angle, which provides, in effect, centerweighted readings at wide-angle settings and full-area averaging readings at 70mm. If you include any very bright objects in a tele shot, this could lead to underexposure of the main subject, so knowledgeable photographers are advised to use the back-light compensation button in such cases.

The IQZoom is such a sophisticated and adept machine compared to almost any other point-and-shoot camera we've tried that it seems a shame that its programmed shutter provides speeds of only 1/40–1/250 sec. We can understand the engineers' desire to minimize camera shake, that great bugaboo of snapshooters and cognoscenti alike, but we would have appreciated an "available light" setting for non-flash indoor shooting, and perhaps an action speed of 1/500 sec. or so. That's the trouble with building one of the world's most advanced point-and-shoot cameras—give it to serious photographers and they'll ask for "just one more" feature.

Despite its inherent limitations, and de-



## GENERAL PERFORMANCE

| Checkpoints                        | Our Standard                                                          | As Tested                                                                                   |
|------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>FINDER:</b>                     |                                                                       |                                                                                             |
| Apparent viewing distance          | Between infinity and 20 in. (0.5m)                                    | 39 in. (1.0m)                                                                               |
| Apparent distance of picture frame | Between 26 in. (0.7m) and 79 in. (2.0m)                               | 52 in. (1.3m)                                                                               |
| View area compared to film area    | Vertically 85%<br>horizontally more than 90%, less than 100%          | Vertical @ 35: 83%<br>@ 70: 77%<br>Horizontal @ 35: 86%<br>@ 70: 81%                        |
| Parallax error compared to film    | Vert. @ 35: 2.0mm<br>@ 70: 2.8mm<br>Horiz. @ 35: 2.6mm<br>@ 70: 3.0mm | Vert. @ 35: 0.4mm down<br>@ 70: 0.9mm down<br>Horiz. @ 35: 0.6mm right<br>@ 70: 0.4mm right |
| Image magnification                | @ 35mm: 0.35X ± 1X<br>@ 70mm: 0.64X ± 1X                              | X.36<br>X.66                                                                                |
| <b>PICTURE SIZE:</b>               | 24 ± 0.6mm x 36 ± 0.9mm                                               | @ 35: 24.1mm x 36.5mm<br>@ 70: 24.1mm x 36.1mm                                              |
| Self-timer delay                   | 7-15 sec.                                                             | 10 sec.                                                                                     |
| <b>CAMERA SIZE:</b>                | 5½ in. wide x 2½ in. high<br>x 2½ in. deep (140 x 75 x 63mm)          |                                                                                             |
| <b>WEIGHT</b>                      | 1 lb. 13½ oz. (507g) with batteries                                   |                                                                                             |

spite the fact that it will never replace the SLR for optical flexibility, framing accuracy, and system compatibility, the Pentax IQ-Zoom is most assuredly a landmark camera. It's facile, it's versatile, it's competent, it handles beautifully and it's lots of fun. In most cases it'll do what you want it to even though it lacks full manual control. Here at last is a point-and-shoot camera comprehensive enough to satisfy the most demanding photographer in search of a fun camera.

**Field test slides:** Our Kodachrome 64 tests slides were all well exposed. Slight softness was detected in the corners of slides taken at the shorter focal lengths. Pincushion distortion could be seen in slides of rectilinear subjects taken with the lens at the 35mm position. Flare was well controlled throughout.

**Optical bench analysis** (for optical experts only): At 35mm, on axis, very slight undercorrected spherical aberration mixed with a very slight red flare, both were gone by approximately f/8, and diffraction limit was reached about f/16. Off axis a very slight skew-ray flare mixed with a very slight coma seen. Slight lateral color was present.

At 70mm we found very slight overcorrected spherical aberration and very slight red flare to f/11. Diffraction limit was reached by f/16. Off axis, very slight coma was present as was lateral color.

## CONTRAST

Pentax Tele Macro 35-70mm  
f/3.5-6.7  
at 35mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 3.5 | Medium     | 36 Medium  |
| 4.0 | High       | 46 Low     |
| 8.0 | Medium     | 48 Medium  |

at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4.8 | High       | 54 Low     |
| 5.6 | Medium     | 46 Medium  |
| 8.0 | Medium     | 42 V. Low  |

at 70mm/30 lines/mm

| f/   | Center (%) | Corner (%) |
|------|------------|------------|
| 6.7  | High       | 56 V. Low  |
| 8.0  | High       | 53 V. Low  |
| 16.0 | Medium     | 43 V. Low  |

## PERFORMANCE

| Our Standard                                                                                                          | as Tested                          |
|-----------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length: ±5%</b><br>(33.25-36.75mm)<br>(66.50-73.50mm)                                                        | 35.53mm<br>68.78mm                 |
| <b>Aperture: ±5%</b><br>(f/3.33-3.68)<br>at 70 mm: (f/6.37-7.04)                                                      | f/3.60<br>f/6.81                   |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>70mm: (±2%)                                                                    | 1.75% (pincushn)<br>0.51% (barrel) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>at f/8-70mm: (0-1.3 stops) | 0.7 stops<br>0.4 stops             |

## RESOLUTION

Pentax Tele Macro 35-70mm  
f/3.5-6.7  
at 35mm/1:36

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 3.5 | Excellent     | 57 Excellent  |
| 4.0 | Excellent     | 64 Excellent  |
| 5.6 | Excellent     | 64 Excellent  |
| 8.0 | Excellent     | 72 Excellent  |
| 11  | Excellent     | 56 Excellent  |

at 50mm/1:35

| f/   | Center (l/mm) | Corner (l/mm) |
|------|---------------|---------------|
| 4.8  | V. Good       | 49 V. Good    |
| 5.0  | Good          | 49 Good       |
| 5.6  | V. Good       | 56 Accept.    |
| 8.0  | V. Good       | 62 Accept.    |
| 11   | Excellent     | 56 Accept.    |
| 11.5 | Excellent     | 56 Accept.    |

at 70mm/1:36

| f/   | Center (l/mm) | Corner (l/mm) |
|------|---------------|---------------|
| 6.7  | Good          | 40 Excellent  |
| 8.0  | Good          | 45 Excellent  |
| 8.5  | Accept.       | 45 Excellent  |
| 11.5 | Good          | 45 Excellent  |
| 16   | Accept.       | 40 V. Good    |

## METERING THE CLASSIC LEICA M6

MANUFACTURER'S SPECIFICATIONS:  
Leica M6 35mm rangefinder camera.

Body No. 1659070. LENS: 50mm f/1.4 Summilux, No. 3251335. SHUTTER: Horizontal cloth focal-plane shutter with speeds of 1-1/1000 sec., plus B, X sync. Combined optical range/viewfinder with projected, auto indexing, auto parallax-compensating bright frames for 28mm, 35mm, 50mm, 75mm, 90mm, and 135mm focal lengths, manual frame selection control. EXPOSURE METERING: Silicon photo diode in body measures 12mm spot on first curtain, reading about 13% of the frame area. Shutter-speed setting and film speed are coupled electronically to comparator twin LED arrow-heads in finder. Readings are made at working aperture. OTHER FEATURES: Accepts accessory Leica Winder-M for battery-operated film advance. X-sync hot shoe, and PC connector on body. PRICE: \$1497, body only; 50mm Summilux f/1.4, \$1,087.50.

Getting a metering system into the renowned Leica rangefinder camera certainly hasn't proven to be an easy task. But you've got to give the engineers of Leitz credit for persevering.

Back in 1971, they brought forth the first meterized rangefinder Leica, the hefty M5, with its peek-a-boo semaphore-mounted CdS cell swinging in place in front of the focal-plane shutter. It provided accurate, convenient "limited area" through-the-lens metering all right, but the camera was noticeably larger and heavier than the traditional M-series Leicas. Its squared-off ends were not as comfortable to hand-hold and its "intersecting lines" match-needle system was not universally admired, despite its accuracy. Though the M-5's shutter and range/viewfinder were the same as those in the M4-2, the model never achieved widespread popularity and was eventually discontinued in 1975.

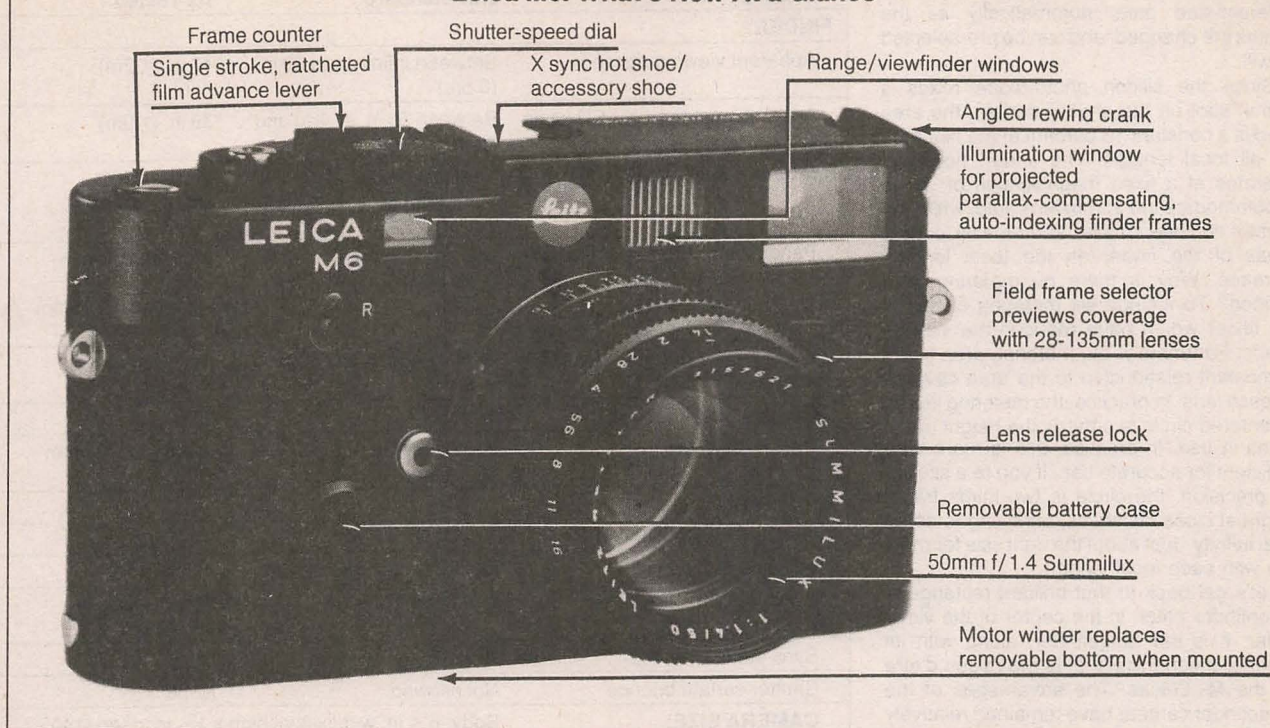
In 1973, Leitz tried once again to give the world a meterized Leica, this time designed for the travelling non-pro. The tiny camera was designed to rival the original screw-mount bodies of the 30's and 40's and was smaller than most hand-held exposure meters. Into this tiny package was packed a totally new, Leitz-designed, vertical, focal plane shutter; a semaphore-mounted photocell evolved from that of the M5 and shutter speed and match-needle indicators in the finder. Perhaps unfortunately, the design did not allow room for a rangefinder sufficiently large to focus the wide aperture 90 and 135mm lenses often used by pros. Without the professional user, the advanced amateur wanting complete optical choice, and the classic Leitz panache (the body was made to Leitz' design by Minolta), the market was not sufficient to support the CL after 1976.

Now, in 1985, with the advent of highly-sensitive silicon photo-diodes, miniaturized high gain metering circuits, LED comparators, and a lot of experience gained from the M5 and the CL, Leitz seems to have pulled off the trick. The new M6 seems to be a particularly happy blend of Leitz' traditionally excellent mechanics and optics with just the right amount of metering electronics to do the job.

Combining the proven selective metering of the M5, the CL, and Leitz' reflexes, the M6 provides an admirably accurate and handy metering system within the trim confines of the traditional M-series Leica rangefinder body. In fact, you'll have to look closely to see any difference between the M6 and the still current, non-metered M4-P.



## Leica M6: What's New At a Glance



The M6 differs from its forbears mainly in its meter system. Few changes seem to have been necessary to incorporate it in the spaces left when the mechanical self-timer was omitted (Leica M4-2 in 1976).

Let's take a look at the new meter. First, note that it's a *metering* system, not an automatic exposure set-up with an electronically-timed shutter. Light is read by a silicon photo-cell mounted in the top of the camera body near the rangefinder mechanism, after it has reflected off a white 12mm spot on the first shutter curtain. Since the light is measured at the lens' working aperture, there are no mechanical or electronic links required. Two red LED arrowheads in the lower part of the finder replace the conventional, relatively fragile meter movement. Unlike the Leica M5 and the Leica CL, there's no CdS cell semaphore swinging in and out of position behind the lens. Also, unlike the M5 and the CL, there are no shutter speed readouts in the finder; only the LEDs glow as a guide to light measurement. You must therefore pay attention to your selected shutter speed to keep out of camera shake territory.

The M6 accepts and meters through almost all lenses mountable on the camera without any mechanical alterations. Only the 21mm Super Angulons and early 28s (prior to serial No. 2314921) have rear elements which extend far enough to interfere with metering. Unlike the M5 and CL, the M6 accepts them without modification for un-metered use. The M6's TTL spot-metering system can even be used with lenses mounted on Leitz reflex housings for macro and telephoto work.

Let's power up. Unscrewing a knurled disc where the self-timer mechanism used to be, just to the left of the lens release, puts the battery case in hand. Popping two 1.55-v silver cells or a single 3-v lithium cell into the clearly marked, spring-loaded holder is a fumble-free procedure. Then just screw it back into its recess. Note that you don't need

a yen, or other coin, to do the job. According to Leitz, a fresh set of batteries will power the LEDs and metering circuitry for about 20 continuous hours (or for 4800 15-second metering cycles). Weak batteries produce a dimmer display. The camera, being mechanical through and through, functions even with dead batteries, or an empty battery compartment. We have yet to be present at the death of a set of batteries so we can't confirm or deny Leitz' figures.

Now set the film speed and raise the camera to your eye. What, can't find the film speed setting dial? It's on the back of the camera, cleverly built into the hinged back panel in place of the traditional film reminder dial. Set your choice of speeds between ASA/ISO 6 and 6400 by pressing in slightly on the center of the dial and turning it. The dial itself is commendably recessed to protect it from accidental shifting in shooting. The film speed settings are transferred to the metering system in the body itself by the three spring-loaded gold contacts. To retain contact alignment, the inspection panel can now only be removed by a camera repairman.

OK, now you can raise the camera to your eye—after preselecting an appropriate shutter speed, and lightly touch the shutter release. One, of two opposing red LED illuminated arrowheads will appear in the bottom of the finder. Turn the lens aperture ring in the direction the arrow points until a second arrow appears. Equalize their brightness by fine-tuning the aperture setting. You've just made a selective area reading accurate to  $\pm 1/4$  stop at the working aperture of your lens. The sensitivity of the metering system is sufficient for split f/stop accuracy, yet not so fussy that it distracts you from your pursuit of the decisive moment. Since the system is manual, you can bracket easily and directly just by dialing your aperture and watching the diodes go through their indicating sequence.

Want to change shutter speeds? Feel free.

A touch on the aperture will bring things back into balance. The shutter-speed dial is coupled to the metering circuit at click-stopped settings from 1 to 1/1000th sec. Like all Leica-M shutters, the M6's can be set repeatably at in-between speeds (except between  $1/15$ th and  $1/30$ th sec.). If the shutter-speed dial could have been coupled continuously to the meter, exposures could also have been fine-tuned with the shutter-speed dial for added convenience, especially in low light work. You could just dial down to lower and lower speeds until your diodes balanced, thus obtaining exactly the right exposure for your maximum aperture. Now you have to reset your speeds while watching the diodes flicker past the set point, and then trim your aperture setting to reach the final exposure.

In actual use, the new metering system proved fast, convenient, and accurate. Sensitivity was sufficient for exposures down to the lower limits of the shutter-speed dial, 1 sec. With 400 speed films and an f/2 lens, a light level of .01 foot candle can be metered; resulting in a 1 sec. exposure. For time exposures, you'll have to do a little figuring in your head since the M6 lacks the M5's extended shutter-speed dial calibrations.

The diodes are brilliant enough to be easily seen in bright outdoor shooting situations. A small, mirrored panel has been added to the lower rim of the viewfinder window to shield them from direct light. In dim light, their brilliance is a trifle distracting. Coupling their brightness to the light level on the scene might increase battery life still further.

There's a lot going on in that finder. We'll sidestep, for the moment, the brilliant central spot that marks the location of the most accurate rangefinder this side of the field artillery. Like the M-4P, the M6 finder carries three sets of interchangeable bright-line projected frame lines covering the full optical range of the camera from 28-135mm. The system compensates for parallax automatically and is sized to the near focusing dis-



## 35MM Non-Reflex

tance of each focal length for maximum accuracy. It rivals the framing accuracy of most SLRs. The frames appear in clearly differentiated pairs automatically as the lenses are changed, and can be pre-selected at will.

Since the silicon photo-diode reads a 12mm spot on the shutter curtain, the area read is a constant 13 percent of the film area for all focal lengths. The finder, however, operates at a fixed magnification of .7x to accommodate the 28mm lens field, while the frames enclose smaller and smaller central areas of the finder as the focal lengths increase. Why is there no metering area defined? To include six metering circles in the finder would have reduced the view to chaos. Fortunately, the metering area bears a constant relationship to the area covered by each lens. In practice, the metering field is a centered circle two-thirds the height of the frame in use. In practice, this is more than sufficient for accurate use. If you're a stickler for precision, the circle is two-thirds frame height at close distances, shrinking to about 1/2 at infinity. Just about the right size for rapid use with each focal length!

Let's get back to that brilliant rectangular rangefinder patch in the center of the viewfinder. It is the rangefinder, along with its superior mechanics, that is the *raison d'être* for the M-Leicas. The advantages of the rangefinder camera have remained relatively unchanged since Leitz introduced its model D, the first rangefinder-equipped, interchangeable lens 35mm camera in 1932. The optics and mechanics of the M-type cameras have been refined continuously since the introduction of the historic M3 more than 30 years ago.

At a distance of 10 feet, even in poor light, a Leica rangefinder can spot focus within an inch or so—more than sufficient accuracy to handle the needs of lenses such as Leitz' 50 mm f/1 Noctilux or the 75mm f/1.4 Summilux used wide open. A rangefinder functions independently of the image thrown by the lens it's linked mechanically; it can be made to focus more accurately than the human eye can focus an image on a focusing screen. And since the focal length and aperture of the lens (and hence its depth of field) do not affect the accuracy of the rangefinder, lenses from a 21mm wide angle to a fast 135mm can be focused to the same rangefinder accuracy all the time.

If you think that wide-angle lenses with their great depth of field don't have to be focused accurately, you should look at your wide angle, wide aperture pictures more critically. You may find that your subject is frequently noticeably less sharp than something trivial just in front of or behind it. Don't misinterpret depth of field—your image is not uniformly sharp through the zone of acceptable focus. The image is always sharpest at the point focused upon and only "acceptable" at the extremes of the zone of focus. Although it may take getting used to, if you're accustomed to a single lens reflex, a rangefinder camera is reassuringly quantitative in focus. Skilled users can prefocus on moving subjects and watch them move into focus, the split images sliding together. It is even possible to follow focus on moving subjects with experience. To focus a rangefinder merely requires turning the mount until the images merge—which is an easy yes/no decision. With a reflex, you often focus *through* the point of focus, and then back,

| GENERAL PERFORMANCE                   |                                                                                                                               |                                                       |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Checkpoints                           | Our Standard                                                                                                                  | As Tested                                             |
| <b>FINDER:</b>                        |                                                                                                                               |                                                       |
| Apparent viewing distance             | Between infinity and 20 in. (0.5m)                                                                                            | 47 in. (1.2m)                                         |
| Apparent distance of LED scale        | Between 56 in. (1.4m) and 23 in. (0.59m)                                                                                      | 39 in. (1.0m)                                         |
| View area compared to film area       | Vertically and horizontally more than 85%, less than 100%                                                                     | Vertical: 86%<br>Horizontal: 86%                      |
| Parallax error compared to film       | Vertical: 1.7mm<br>Horizontal: 2.5mm                                                                                          | Vertical: 0.15mm (down)<br>Horizontal: 0.15mm (right) |
| Focusing accuracy at maximum aperture | Within depth of focus                                                                                                         | No Discrepancy                                        |
| Image magnification                   | 0.7X ± .1X                                                                                                                    | 0.7X                                                  |
| <b>PICTURE SIZE:</b>                  |                                                                                                                               |                                                       |
|                                       | 24 ± 0.6mm x 36 ± .09mm                                                                                                       | 24.0mm x 36.0mm                                       |
| <b>SHUTTER:</b>                       |                                                                                                                               |                                                       |
| Curtain travel evenness               | ±0.33 stop                                                                                                                    | 0.10 stop                                             |
| Insulation from sync                  | More than 7 megohms                                                                                                           | Infinity                                              |
| Sync contact efficiency               | More than 60%                                                                                                                 | 89% (hot shoe)<br>92% (pc)                            |
| Sync delay time                       | X: within full opening                                                                                                        | Okay                                                  |
| Shutter curtain bounce                | Not allowed                                                                                                                   | None                                                  |
| <b>CAMERA SIZE:</b>                   |                                                                                                                               |                                                       |
|                                       | Body: 5 1/2 in. wide x 3 in. high x 1 3/8 in. deep (140 x 78 x 35mm)<br>Lens: 1 3/4 in. long, 2 1/16 in. diameter (45 x 52mm) |                                                       |
| <b>WEIGHT:</b>                        |                                                                                                                               |                                                       |
|                                       | Body: 1 lb. 3 1/2 oz. (554g) with batteries<br>Lens: 10 1/8 oz. (289g)                                                        |                                                       |

closing in on that elusive point where the image is as sharp as possible. This takes more time and is a less positive action.

Unlike the M5 and the CL, the M6 has no internal shutter-speed readouts, so you'll have to look at the top of the camera from time to time to keep track of your shutter speeds. A warning light in the finder for speeds below 1/50 sec. might have been a help. Since the shutter-speed dial has positive stops at both B and 1/1000 sec., you can set speeds by counting clicks in either direction even in total darkness. A minor change in styling has removed the no-longer-needed groove in the dial which was used for coupling Leica meters. Obviously, it was not needed for the M6, which has its own meter inside, but you could tell by touching the dial when the camera was set at 1/30 sec. or lower. At 1/30, the slot was all the way to the front of the camera. Perhaps it's nit picking, but you do need to know conveniently and quickly what your shutter's doing time-wise at low light levels while you're trying to get a balanced exposure reading. Having a meter so conveniently present in the finder, tends to make it easier to forget what's happening on the shutter dial up top. Cultivate a little self-discipline, and keep looking at your settings.

The new Leica Winder-M has been redesigned so that it has a tripod socket, and the battery holder is easily removable when the camera and winder are tripod-mounted. The new tripod mounting foot extends between the motor itself and the end of the battery case. With the release partially depressed, up to 3 frames per second may be exposed with the winder—and it is barely audible.

Rangefinder cameras have always been favored by flash photographers. You can actually see the flash going off! With a reflex,

the mirror's always up when the flash goes off. Although the M-contact for flashbulbs has been removed from the M6, most bulbs can be used up to 1/30 sec. Focal plane bulbs, if you can still find them, are restricted to 1/15 sec. tops, which ought to make them relatively useless. To offset this, you can fire one electronic flash in the x-synched hotshoe and another plugged into the synch socket simultaneously to double your light output.

Minor quibbles aside, the M6 seems a particularly practical and well-crafted addition to Leitz' line—a real M-camera in every way. They've added just the features needed to make a commendably practical classic camera even more convenient to work with, without sacrificing quality or controllability. A new generation of quiet, reliable and accurate rangefinder cameras may be finding their way into the kits of pros and non pros appreciating their many advantages. Best news of all is that the M6 carries a list price only \$150 higher than that of the M4-P. This difference is about half the price of a new shutter-coupled MR meter for the older cameras. To say that you get your money's worth in added operating speed, convenience, and exposure accuracy is an understatement.

The rangefinder camera is for the connoisseur. Leitz' new M6 provides just the right balance of electronic convenience and traditional mechanical excellence.

Leitz, in recent years, has been adding new focal lengths and improved versions of already legendary lenses to their lens line with little fanfare. We've tested five of the newer lenses, including, on the next page, the latest version of the 50mm f/1.4 Summilux; future published tests will include the 75mm f/1.4 Summilux. (June '85)



## FAST 50mm f/4 LEITZ

**Specifications:** 50 mm f/1.4 Leitz Summilux, No. 3251335; Leica M-type bayonet mount accepts 43mm threaded filters; f/1.4-16 with detents at 1/2-stop intervals; min. foc. dist.: 3 ft. 4 in. (1m); 1 3/4 in. long, 2 in. in diam.; 10 1/8 oz.; \$1,087.50 with hood and end caps.

**Practical comments:** Lightweight, compact high speed normal lens; 1 5/16-in. wide straight knurled focusing ring turns clockwise from infinity to min. foc. dist. with silky smoothness; 1/8-in. wide straight knurled aperture ring. Aperture, meter and depth-of-field scales in white, focal length and footage scales in gold. Raised red orientation dot. Bayonet mounts and locks with 30 degree clockwise turn. Superior matte-black finish.

**Field test slides:** Our Kodachrome 64 slides were crisp and snappy with detail well-rendered throughout. Wide open, corner to corner sharpness was good with detail well

rendered even in the corners. Some light fall-off was noted, gone by f/2. Flare was well-controlled throughout. An above-average lens for a fast 50.

**Optical bench report** (for optical experts only): On axis, we saw very slight over-corrected spherical aberration with very slight red flare; gone by f/8. Diffraction limited by f/8. Off Axis, slight skew-ray flare was mixed with very slight astigmatism. Minimal lateral color was seen. (June 1985)

### PERFORMANCE

| Our Standard                                                                      | as Tested         |
|-----------------------------------------------------------------------------------|-------------------|
| <b>Focal length:</b> +5%<br>(47.50-52.50mm)                                       | 51.70mm           |
| <b>Aperture:</b> +5%<br>(f/1.33-1.47)                                             | f/1.45            |
| <b>Distortion:</b><br>(+1.5%)                                                     | under 1% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.8 stops         |

Charts continue on page 177

# 2 1/4 SINGLE LENS REFLEX

## Bronica GS-1: Easy Handling, Multi-Format 6×7cm SLR

**SPECIFICATIONS:** Bronica GS-1 6×7cm (2 1/4×2 3/4 in.) single-lens reflex camera. Body No. 4100929. LENS: 100mm f/3.5 Zenzanon PG in Bronica GS bayonet mount, No. 10000590. SHUTTER: Electronically-controlled Seiko #0 leaf in each lens, shutter speeds from 16 sec. to 1/500 sec. plus T, B, and A (auto-exposure) setting with AE Prism Finder G. EXPOSURE SYSTEM: With AE Prism Finder G, two silicon cells at rear of finder provide center-weighted readings off finder screen for aperture-preferred auto-exposure, metered manual exposure; EV2-17 (at ISO 100); ISO/ASA 3-6400; exposure compensation ±3 stops in 1/2 stop increments; AE lock holds auto-exposure for 16 sec, permits auto-exposure operation with mirror up. FLASH: Dedicated hot shoe on accessory Speed Grip G provides autoflash readings off film surface (OTF) with Bronica Speed-Light G1 via silicon cell in side of mirror box; X sync at speeds to 1/500 sec. via PC outlet on body. VIEWFINDER: Interchangeable finders and screens; standard screen has central fine matte circle, fine-lined Fresnel outer focusing area; LEDs atop screen indicate shutter status dark slide in with chest-level finder; with AE Prism Finder G LEDs show

camera-selected shutter speed in half stops, or manual speeds in whole stops plus deviation from correct exposure to ±3 EV, flash ready, AE lock in use. OTHER FEATURES: Separate film backs for 120 or 220 film provide either 6×7cm (2 1/4×2 3/4 in.), 6×6cm (2 1/4×2 1/4 in.), 6×4.5cm (2 1/4×1 1/2 in.), or wide 35mm (24×69mm) formats; Polaroid pack film back; detachable film-wind crank or Speed Grip G winds film, cocks shutter, advances counter in attached film magazine, film speed and exposure-compensation settings on film magazine back are keyed into attached meter prism via twin contacts; multiple exposure and mirror lock-up levers on body, depth-of-field preview lever on each lens; power switch on body; electromagnetic cable release socket. BATTERIES: One 6-volt silver-oxide or alkaline manganese cell powers shutter-timing and LED readout circuits. PRICE: \$1810, with normal lens standard 120 film back and chest-level finder; Speed Grip G, \$210; AE Prism Finder G, \$735.

When Bronica's engineers told us way back in '83 that they had a 6×7cm SLR in the works, we wondered what kind it would be—a scaled up 35mm SLR like the venerable Pentax 6×7, or a studio-style, bellows-focusing model with revolving back in the manner of Mamiya's mighty RB's. When, after much discussion, they revealed that Bronica's 6×7 would be "similar to a scaled-up Bronica SQ-A" with helical-focusing leaf shutter lenses, interchangeable film magazines, and a non-revolving back, we were frankly skeptical. Could such a beast really fly? Wouldn't it han-

dle rather strangely? Could you actually shoot verticals with it without going into contortions? "Trust us," said they, "Our new 6×7 will not only be smaller and lighter than its competitors, it will also handle very nicely and sport state-of-the-art electronics."

With our appetites thus whetted and our design concepts challenged, we waited for nearly a year while Bronica labored to get their "big baby" to the production stage. Finally we were notified that the new GS-1 was available, and we decided to get a complete outfit, including film backs, waist-level and AE Prism Finder G, Speed Grip G, SpeedLight G1, and three lenses, the standard 100mm f/3.5 Zenzanon-PG, wide angle 65mm f/4 Zenzanon-PG and medium tele 150mm f/4 Zenzanon-PG. It was a wise decision since we soon discovered that the GS-1 is such a completely integrated "system camera" that evaluating this unique machine would have been impossible without analyzing its major accessories and putting them through their paces in our field tests.

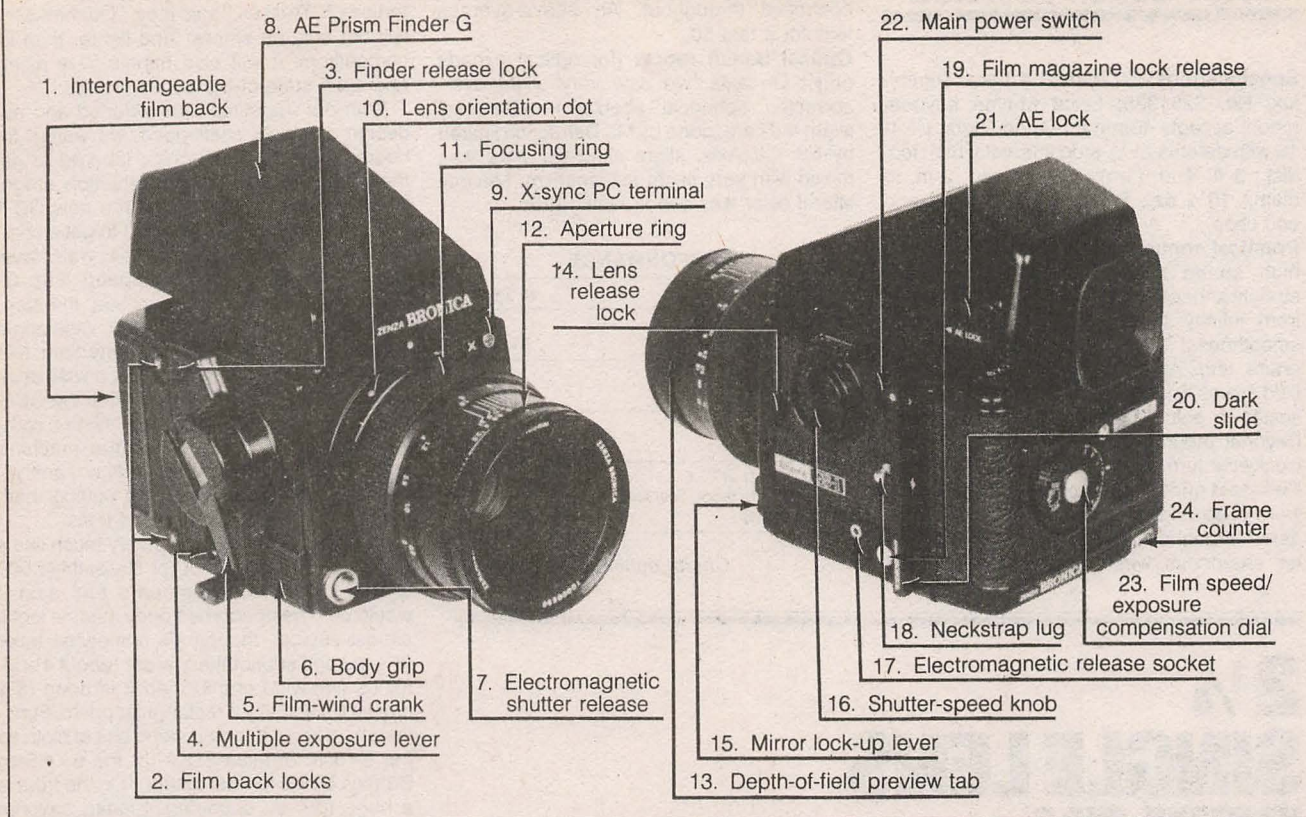
The basic GS-1 is indeed very much like a scaled-up Bronica SQ-A (or Hasselblad 500 C/M)—just as the engineers had said it would be. The unadorned body module looks almost cubical, though it's somewhat taller (3 3/8 in.) and substantially wider (about 4 1/2 in. minus film-wind crank) than it is deep (3 1/8 in.), so it's actually a rectangular prism. Functionally, it is cut from the same bolt of cloth as the 6×6cm Bronica SQ-A (or the 6×4.5cm Bronica ETRS for that matter). On the front is a huge (3 1/4 in. diameter) 4-lobed bayonet mount with six gold-plated contacts just inboard of the top lobe. On the top resides the interchangeable viewing screen with six flat, gold-plated meter prism contacts arrayed on each side of a rectangular LED panel along its front-facing edge. On the back you'll find the mounting plate, various receptacles, locks, and pins for the film back, plus the film-winding gear, and on the bottom is the battery compartment, tripod socket, film-advance coupling for the Speed Grip (or winder) and yet another array of seven flat, gold-plated contacts for dedicated autoflash operation via the hot shoe atop the Speed Grip G. Like the SQ-A, the GS-1 has its shutter-speed control on the upper part of the left-hand side, and its removable film-wind crank on the right-hand side.

To achieve a functioning camera, let's add a lens, film back and finder. To mount the (100mm normal) lens, line up the raised red dot on the knurled ring at the back of the barrel with a white dot on the front of the body, insert the lens and turn it about 35° counter-clockwise until it seats with a soft click. Now mount the film back by hooking the top mounting tabs on its front into slots just below the rear of the finder screen housing, and hinging the back downward until it clicks into place. Finally, attach the chest-level finder in its folded position by placing it atop the finder screen with the nameplate facing toward the front, and sliding it forward until it clicks into place.

Now that the basic Bronica is ready to go, let's check the battery. First grab the striated finger grips on either side of the rear of the folded finder top with your thumb and forefinger, lift the top and swing it forward until the hinged sides of the focusing hood are erected—a convenient one-handed operation. Now push a small tab at the top, front edge of the finder to the left, and the light-excluding top plate with interchangeable



## What's New At A Glance?



magnifier pops up into place. Turn on the power by pushing down the main power switch behind the shutter-speed dial, and (with the dark slide still in the film back) press the shutter release partway in while looking through the finder. If the battery's OK, a red LED atop the finder screen will light up. Pull out the dark slide from the left-hand side of the film magazine and press the shutter release all the way in and this same LED will blink the instant the shutter closes. To the left of the red LED, there's a green LED which lights to indicate that an attached dedicated flash has recycled. With the chest-level finder in place, *only these two LEDs* are visible. The GS-1 becomes an auto-exposure and manual metering camera only with the AE Prism Finder.

Though you can load the 120 film back while it's attached to the camera, let's remove it for convenience. Note the dot-in-circle mark on the dark slide handle, and hold the slide so this mark is at the top. Now insert the slide into the vertical slot on the left-hand side of the film back, just in front of the film plane mark, and push it all the way in. Then push in a silver button just in front of the lower edge of the slide, hinge the bottom of the back away from the camera and lift it off from the top. On the right-hand side of the film back are two tabs, one with a down-pointing arrow, the other with an up-pointing arrow. Push in both simultaneously as indicated and the magazine's hinged back pops open. Swing the back toward the left and you're greeted with a nicely made, conventional film insert with convenient, hinged spool retainers on top that advances the film right-to-left. Pop a fresh roll of film into the right-hand chamber, pull the paper leader black side out over the pressure plate in front, attach the end of the paper into the take-up spool and advance

the roll manually by turning the gear below the pressure plate (or the take-up spool) until the vertical arrow on the paper backing coincides with a red delta at the top of the film supply spool. Place the insert into the magazine and snap it shut.

Before re-mounting the film back set the ISO/ASA dial on its back, the exposure-compensation dial if required, and insert a film box end into the adjacent clip as a reminder. Both film speed and compensation data are keyed into the attached meter prism by way of a pair of flat, gold-plated contacts atop the magazine. After re-mounting the loaded back, unfold the film-wind crank, and turn it forward about 3½ turns until it stops and number 1 will appear in the frame counter at the bottom right-hand corner of the magazine. Finally, remove the dark slide—unfortunately there's no place on the camera to store it—and you're ready to shoot.

With the chest-level finder in viewing position, the basic GS-1 is surprisingly deft and handy for a 6×7cm SLR. It's reasonably light, very well balanced, and it functions very smoothly and ergonomically. With both hands cradling the camera, left thumb and index finger grabbing the wide (¾ in.) focusing ring on the normal lens, and right index finger poised over the shutter button, it feels just as comfortable and natural as a Bronica SQ-A or Hasselblad. The shutter-speed window atop the left-hand side of the body is easily viewable with a quick sideward glance and very legible with large, clear white-on-black numerals (except for red digits from 1 sec. to 16 sec.). The wind crank on the right nestles comfortably below your right thumb and advances film in a smooth 180° stroke (you can also wind it back in a counter-clockwise direction to get the handle into a more comfortable position).

Focusing action is likewise smooth but well damped and secure, and the view through the viewfinder is quite bright, with excellent contrast, very good focusing precision, and (with the chest-level finder) a moderate amount of pincushion distortion. Even the depth-of-field preview on each lens and the mirror lock-up lever (on the lower left-hand front corner of the body) "fall readily to hand." The multiple-exposure lever behind and below film wind crank is also handily placed for use but sufficiently out of the way.

If the basic GS-1 succeeds in handling like a 6×6cm (2¼ square) SLR despite its larger-format capabilities, this is all to the good—provided you're shooting horizontal pictures or the camera is fitted with an alternative 6×6cm film back. However, unless you're content to mount the camera on a 90° tilt-head tripod and view upside-down, you can't shoot vertical 6×7cm images unless you install a prism finder. So, let's fold up our chest-level finder, press in the finder release button behind and above the film-wind crank, slide the finder back about ¼ in. and lift it off. And so long as we're fitting a prism, let's make it the "full function" AE Prism Finder G, which mounts securely and swiftly using the reverse procedure.

With the AE prism in place, you can still see the entire viewing area quite comfortably even with glasses, and with less noticeable pincushion distortion and almost equivalent brightness. More importantly, you can see the entire 5-digit, 7-segmented metering LED array (in addition to the aforementioned warning LEDs) when you turn on the main power switch and press the shutter release partway in. The type of display you'll see depends on which metering mode you select.

The AE prism provides essentially two  
Photo Buying Guide/89



metering modes—aperture-preferred auto-exposure and metered manual mode. To select the former, turn the shutter-speed control clockwise to the "500" (1/500 sec.) setting, press in a small lock-out button on the control knob, and turn the dial one more notch until it clicks in at the "A" setting. Presuming that the film speed is correctly set and the main power switch turned on, you now select your shooting aperture by turning the thin (1/16 in.) aperture ring to the desired aperture, and press the shutter button partway in while looking through the finder. The correct camera-selected shutter speed will now appear in red LED digits just above the center of the viewing screen. The indications are reasonably large, very clear and legible and their brightness is automatically adjusted in two steps depending on the shutter speed in use. Speeds of 1 sec. and slower are displayed in full stops down to 16 sec. and are denoted by a second mark (") after the digits. Speeds of 1/2 sec. and faster appear in half steps as follows—2, 3, 4, 6, 8, 10, 15, 20, 30, 45, 60, 90, 125, 180, 250, 350, and 500. If overexposure will result at 1/500 sec. at your chosen aperture, or if the light level is above the meter's range, the "500" will flash about twice per sec. If the light level is too low for the meter to measure or underexposure will result at the slowest timed speed, the 16" indication flashes in a similar manner.

All in all the GS-1's auto-exposure mode is eminently simple and straightforward in actual use. Indeed those weaned on contemporary 35mm SLRs with aperture-preferred AE will require no familiarization at all. However, the system incorporates a few thoughtful touches that are particularly welcome on a professional camera. First, the electromagnetic shutter release, though commendably smooth in operation, has a sufficiently long throw so that one is unlikely to fire the camera accidentally while pressing the button partway in to meter. Then there's the AE lock on the back left-hand section of the AE prism. Push the switch forward as indicated by the arrow, and the meter system will hold any exposure reading made in the AE mode for 16 sec. This enables you to take close-up readings, or readings of important parts of the subject, then step back (or recompose) and shoot. This popular professional metering method combines the precision and accuracy of manual metering plus the speed and convenience of auto exposure. And since the GS-1's metering system is of the "full area center-weighted" type, you can, in effect, make "spot" meter readings in auto mode in this manner—providing you can get close to the subject. Incidentally, when the AE lock is in use a greenish LED to the left of the shutter-speed readouts remains lit as long as the initial reading is being held, and this includes readings taken before the mirror is locked up—a clever and useful feature.

The GS-1's manual metering mode is equally ingenious and practical. To select it, you simply push in the button to unlock the "A" setting and set the shutter control to a timed shutter speed (set it to B and the readouts show "bul" and the meter circuits are turned off). Now, with the power switch on, turn the meter on by partially depressing the shutter button and, atop the finder field you'll see the rapidly flashing digits of your *selected shutter speed*, and to their right, another digit telling you how far away you are from the camera-determined "correct metered exposure." All these manual metering numbers

| GENERAL PERFORMANCE                   |                                                                                                                                                                         |                                                    |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Checkpoints                           | Our Standard                                                                                                                                                            | As Tested                                          |
| <b>FINDER:</b>                        |                                                                                                                                                                         |                                                    |
| Apparent viewing distance             | Between infinity and 20 in. (0.5m)                                                                                                                                      | 39 in. (1m)                                        |
| View area compared to film area       | Vertically and horizontally more than 90%, less than 100%                                                                                                               | Vertical: 96%<br>Horizontal: 94%                   |
| Apparent distance of viewfinder LEDs  | Between 79 in. (2.0m) and 26 in. (0.66m)                                                                                                                                | 33 in. (0.83m)                                     |
| Parallax error compared to film       | Vertical: 1.1mm<br>Horizontal: 2.0mm                                                                                                                                    | Vertical: 0.2mm (down)<br>Horizontal: 1.4mm (left) |
| Focusing accuracy at maximum aperture | Within depth of focus                                                                                                                                                   | No Discrepancy                                     |
| Image magnification                   |                                                                                                                                                                         | 0.37 ×                                             |
| <b>PICTURE SIZE:</b>                  | 56 ± 1.4mm x 69.5 ± 1.7mm                                                                                                                                               | 55.4mm × 69.2mm                                    |
| <b>SHUTTER:</b>                       |                                                                                                                                                                         |                                                    |
| Insulation from sync                  | More than 7 megohms                                                                                                                                                     | Infinity                                           |
| Sync contact efficiency               | More than 60%                                                                                                                                                           | 82% (pc)                                           |
| Sync delay time                       | X: within full opening                                                                                                                                                  | Okay                                               |
| <b>CAMERA SIZE:</b>                   | Body: 5 1/16 in. wide × 4 5/8 in. high (with folded finder) × 5 1/16 in. (with back) (132mm × 118mm × 129mm)<br>Lens: 2 5/8 in. long, 3 1/16 in. diameter (68mm × 85mm) |                                                    |
| <b>WEIGHT:</b>                        | Body: with waist level finder, magazine back and batteries- 2 lb. 13 3/4 oz. (1298g)<br>Lens: 1 lb. 5 13/16 oz. (620g)                                                  |                                                    |

including 0 (that is, zero deviation, denoting the correct exposure) normally remain lit as long as you hold in the shutter release. Those denoting underexposure are preceded by a minus sign while those indicating overexposure have no sign. If you exceed the metering readout range of -3 stops to plus 3 stops away from the correct exposure, either the -3 or the 3 flashes rapidly along with the user-selected shutter speed digits. Furthermore, within the range of -2 stops to plus 2 stops, the system reads out in half stops—for example, .5, 1, 1.5, 2—thus matching the half-stop detents on the lens aperture ring. Unless you are deliberately overexposing or underexposing you meter manually by turning either the shutter-speed dial, the aperture ring, or both until the shutter speed you want plus the correct exposure (0) appear in the finder.

The GS-1's manual metering system offers sufficient selectivity for most professional purposes, since a correct-exposure indication means you're within a half stop of the correct exposure according to the metering system. (Incidentally, Bronica claims the system executes in 1/6 stop intervals in auto mode!) Like the auto metering mode it is also conceptually and operationally simple and unconfusing—and once you push the shutter button partway in you're never in any doubt as to which mode you're in, or how to proceed when you find out. Our only gripe is a minor one—since you can only set manual shutter speeds in whole-stop intervals (e.g., 1, 2, 4, 8, 15, 30, 60, 125, 250, 500 settings on the dial) you may have to "touch up" the aperture dial to obtain a correct exposure readout when using the "aperture-preferred" manual

metering method.

With the AE prism and the standard film-wind crank in place, the GS-1 still handles very well—for a prism-equipped 6×7cm SLR. However, its overall balance is not improved by adding 16 1/2 oz. of extra weight to the top of the body. Also, the rear overhang of the prism, while effective in getting the eyepiece in the proper location for comfortable viewing, blocks your view of the top film-back-mounting slots. Result: You've got to tilt the camera front down to see the slots and re-attach back with somewhat greater care.

While shooting horizontals is still reasonably comfortable and handy with the prism in place, turning the camera 90° to the left for shooting verticals is only marginally so. It's not bad for an occasional vertical shot, but your left wrist would tire rapidly if you had to shoot sequences with the camera held in this orientation. The solution to this dilemma—and the only way to add the virtues of a dedicated OTF flash system to the camera—is to attach the Speed-Grip G.

The GS-1's Speed Grip is essentially a somewhat enlarged version of the Speed Grip found on the Bronica ETRS and the SQ-A and it's equally useful and vital to the smooth functioning of the GS-1 system. To mount the Grip, you must first remove the standard film-wind crank—one of the few finicky procedures on the entire camera. To do so, you pull outward on a little spring-loaded tab just inboard of the outer round knob of the crank and then, while holding the button against spring tension, grab and turn the inner rubber ring on the crank about 1/2 in. counter-clockwise. Some staff members found this operation impossible, a few found



## 2 1/4 Single Lens Reflex

it difficult and one found it easy. None found it very comfortable. In contrast, actually mounting the Speed Grip is simplicity itself—just turn the camera over with its bottom facing upwards, align the tripod screw and locating studs with the appropriate receptacles on the camera bottom, lift the D-ring on the bottom part of the grip and screw the mounting screw firmly but gently into the tripod socket. The keyway on the Grip that mates with the film-wind connector on the camera bottom is spring-loaded so it needn't be in precise orientation when you mount the grip—just wind the 35mm-style wind lever atop the hand grip once and it will automatically engage.

With the Speed Grip in place, both the handling and balance of the prism-equipped GS-1 improve dramatically, for in addition to providing a more comfortable and secure way of holding the camera, the grip offers several other operational advantages. First of all, the rounded "knob" section of the top of the grip incorporates a second electromagnetic shutter release which is perfectly positioned under your right index finger. Indeed, the grip itself is wonderfully "anatomical" and much more comfortable than many finger-notched grips described as such. Then there's the film-wind lever—a very smooth, ratcheted two-stroke device which provides a much more comfortable way to advance film rapidly with the camera held at eye level than any crank possibly could. Directly in front of the nicely contoured wind lever, on a little raised platform, is what is literally and figuratively its crowning glory—a 3-contact dedicated hot shoe which is connected to the camera's electronics via 7 spring-loaded contacts atop the mounting base of the grip that mate with a similar array of flat contacts located on the bottom plate of the camera body.

But before we delve into the Bronica's sophisticated flash system, let's say a word about its handling with the grip in place. The word is superbly. Indeed, so equipped, the GS-1 may just be the best handling field camera of any 6×7cm SLR in production. Of course you have to read these remarks in context. While the GS-1 is not monstrously large for a 6×7 SLR it is hardly a lightweight, and it's bound to feel ponderous to those used to shooting with 35s. However, in the comfort and handling departments it can give several well known 6×6s a run for the money and that's really saying something. Specifically, when shooting horizontals with the Speed Grip and AE Prism, the GS-1 feels very much like an oversized 35 despite its boxy contours. And as for shooting verticals, this requires an "overhead grip" that's considerably handier and more comfortable than it looks.

Slide the dedicated Bronica Speed-Light G1 into the shoe atop the grip and tighten down the locking screw and this moderate-sized, lightweight (15 1/2 oz. with batteries) 4-AA-cell unit hardly alters the GS-1's balance or handling at all. Featuring 4 autoflash apertures, plus manual and TTL off-the-film (OTF) modes, a flash head which tilts up to 90° (with click stops at 0°, 45°, 60°, 75°, and 90°) swivels a total of 90° (up to 45° to left or right) and has four power output settings down to 1/8 power, it's a good basic unit, but not a truly professional one. Its output is reasonable for its size (a guide number of 105 on full power with ISO 100 film), but though it incorporates energy-saving thyristorized circuitry, its film speed settings range from only 25-400, it lacks any connectors for remote or slaved

operation, or for remote sensors. However, Bronica plans to remedy this situation with more professionally oriented flash units in the future.

The most agreeable feature of the Speed-Light G1 is undoubtedly its TTL off-the-film (OTF) flash-metering capability, a system providing much more accurate flash metering than front-of-the-unit sensors, particularly with extreme close-up and multiple flash lighting. Set the switches on the back of the flash to "Bronica" (for dedication) and the range/mode selector switch to TTL and two marvelous things happen. Touch the shutter button and when the flash has recycled you'll see a green LED to the right of the metering digits in the finder (with prism attached), and you can now select any aperture you desire for TTL, OTF autoflash. This system employs a sensor on the side of the mirror box that points toward the film and reads and adjusts the light reflected off the film during the exposure itself. The good news: You can press in the combined ready light/test button in any of the non-TTL autoflash modes, and then glance at the Autocheck (flash confirmation) light on the back of the unit, which flashes green for about 1 sec. if the light output is sufficient. Unfortunately, Bronica's system does not include flash exposure confirmation signal in the finder, and you must actually shoot a picture to find out whether the flash output is sufficient in TTL mode. Too bad. As for its on-film performance, we're pleased to report that our flash exposures on Ektachrome 64 were all well within accepted exposure tolerances and the unit covered the field of view of the 65mm wide-angle lens without noticeable light falloff, even without fitting the accessory wide-angle diffuser panel.

In general we were very well pleased with the performance and handling of our test Bronica GS-1 and can recommend it to professionals and advanced amateurs seeking a flexible, well thought out, medium format SLR system. Its lack of a revolving back imposed far fewer handicaps than we would have imagined, and has paid off in a smaller (though still hefty), mechanically simpler camera offering excellent field performance.

Another feature bound to appeal to pros is the GS-1's format flexibility. With appropriate backs and a choice of 7 viewing screens (including two inscribed with vertical lines defining the 6×6 and 6×4.5cm formats) you can literally match the format to suit the subject or assignment. The 35mm back (not tested) offers unique and valuable picture taking possibilities not possible with most other medium-format SLRs (though we have yet to see the viewing screens marked for the wide 24×69mm 35mm format). As befits a camera in its rather exalted price range, the GS-1 is solidly constructed, well finished, and (within the necessarily limited parameters of our 6-month test procedure) rugged and dependable. Nicely done. (April 1985)

## BRONICA GS-1 LENS TESTS

**Specifications:** 65mm f/4 Zenzanon-PG no. 6501061 in Bronica GS-1 bayonet mount, accepts 72mm accessories, f/4-f/22 with half-stop detents throughout, min. foc. dist. 2 ft. (0.6m); 2 1/8 in. long 3 3/8 in. diam. (71 × 87mm), 1lb. 9 3/16 oz. (715g), \$940.00.

**Specifications:** 100mm f/3.5 Zenzanon-PG no. 10000590 in Bronica GS-1 bayonet mount, accepts 72mm accessories, f/3.5 (4)-22 with half-stop detents throughout, min. foc. dist. 2 ft. 6 in. (0.75m); 2 1/16 in. long, 3 3/8 in. diam. (67.5 × 87mm) 1lb. 3 3/16 oz. (630g), \$620.00.

**Specifications:** 150mm f/4 Zenzanon-PG no. 15601191 in Bronica GS-1 bayonet mount, accepts 72mm accessories, f/4-22 with half-stop detents throughout, min. foc. dist. 5 ft. (1.5m); 2 7/16 in. long, 3 3/8 in. diam. (62 × 87mm) 1lb. 3 3/8 oz. (650g), \$880.00.

**Practical comments:** All three Zenzanon-PG lenses are well finished in satin black with large, legible white-on-black numerals except for footage scales in orange on black. Depth-of-field scales on barrels are very complete, include infrared focus index. Wide, textured rubber focusing rings are easy to grip; focusing action smooth and well damped, aperture rings thinner and less grippable but satisfactory. Red alignment dots on knurled mounting rings allow easy mounting and removal; depth-of-field preview controls on barrel conveniently placed; external bayonet lugs on front rings in addition to filter-mounting thread. All lenses turn clockwise to closest focusing distance; 65mm, 180° from infinity to min. foc. dist.; 100mm, 270°; 150mm, 160°.

**Field test slides 65mm f/4:** Corner images slightly softer than center at f/4, but improve greatly by f/5.6. Transparencies crisp and snappy with fine detail sharply rendered. Flare well controlled throughout. Overall, above average performance.

100mm f/3.5: Center-to-corner definition holds very well at all apertures. Transparencies crisp, sharp, and snappy. Flare well controlled throughout. Overall, above average performance.

### PERFORMANCE

| Our Standard                                                                      | as Tested    |
|-----------------------------------------------------------------------------------|--------------|
| <b>Focal length</b> ±5%<br>(61.75-68.25mm)                                        | 66.88mm      |
| <b>Aperture</b> ±5%<br>(f/3.80-f/4.20)                                            | f/4.06       |
| <b>Distortion</b><br>(±3%)                                                        | 0.6 (barrel) |
| <b>Light fall off</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-2.1 stops) | 1.25 stops   |

### RESOLUTION

| BRONICA ZENZANON 65mm f/4<br>at 1:20 |                  |    |                  |    |
|--------------------------------------|------------------|----|------------------|----|
| f/                                   | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4                                    | Excellent        | 40 | Excellent        | 36 |
| 5.6                                  | Excellent        | 50 | Excellent        | 36 |
| 8                                    | Excellent        | 63 | Excellent        | 40 |
| 11                                   | Excellent        | 57 | Excellent        | 40 |
| 16                                   | Excellent        | 50 | Excellent        | 40 |
| 22                                   | Excellent        | 45 | Excellent        | 36 |

### CONTRAST

| BRONICA ZENZANON 65mm f/4<br>at 30 lines/mm |                  |    |                  |    |
|---------------------------------------------|------------------|----|------------------|----|
| f/                                          | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4                                           | High             | 70 | High             | 29 |
| 5.6                                         | High             | 71 | High             | 30 |
| 8                                           | High             | 74 | High             | 34 |
| 11                                          | High             | 71 | Medium           | 31 |
| 16                                          | High             | 65 | Medium           | 28 |
| 22                                          | High             | 48 | Medium           | 27 |



150mm f/4: Center-to-corner definition holds well at all apertures. Fine detail well rendered; transparencies crisp and snappy. Flare well controlled throughout. Overall,

### PERFORMANCE

| Our Standard                                                               | as Tested     |
|----------------------------------------------------------------------------|---------------|
| Focal length $\pm 5\%$<br>(95.00-105.00mm)                                 | 100.81mm      |
| Aperture $\pm 5\%$<br>(f/3.33-f/3.68)                                      | f/3.52        |
| Distortion<br>( $\pm 2\%$ )                                                | 1.5% (barrel) |
| Light fall off at f/5.6<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 1.2 stops     |

### RESOLUTION

| BRONICA ZENZANON 100mm<br>f/3.5 at 1:20 |                  |    |                  |    |
|-----------------------------------------|------------------|----|------------------|----|
| f/                                      | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                     | Good             | 29 | Excellent        | 29 |
| 4.0                                     | V. Good          | 32 | Excellent        | 32 |
| 5.6                                     | Excellent        | 36 | Excellent        | 32 |
| 8                                       | Excellent        | 41 | Excellent        | 36 |
| 11                                      | Excellent        | 45 | Excellent        | 41 |
| 16                                      | Excellent        | 45 | Excellent        | 41 |
| 22                                      | Excellent        | 41 | Excellent        | 36 |

### CONTRAST

| BRONICA ZENZANON 100mm f/3.5<br>at 30 lines/mm |               |    |               |    |
|------------------------------------------------|---------------|----|---------------|----|
| f/                                             | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                            | High          | 59 | Medium        | 23 |
| 4                                              | High          | 58 | High          | 33 |
| 5.6                                            | High          | 60 | High          | 42 |
| 8                                              | High          | 76 | High          | 43 |
| 11                                             | High          | 68 | High          | 39 |
| 16                                             | High          | 60 | Medium        | 30 |
| 22                                             | High          | 50 | Medium        | 29 |

### PERFORMANCE

| Our Standard                                                               | as Tested         |
|----------------------------------------------------------------------------|-------------------|
| Focal length $\pm 5\%$<br>(142.50-157.50mm)                                | 150.83mm          |
| Aperture $\pm 5\%$<br>(f/3.80-f/4.20)                                      | f/4.038           |
| Distortion<br>( $\pm 2.5\%$ )                                              | 2.05 (pincushion) |
| Light fall off at f/5.6<br>+1 stop from theoretical limit<br>(0-1.2 stops) | .75 stops         |

### RESOLUTION

| BRONICA ZENZANON 150mm f/4<br>at 1:20 |                  |    |                  |    |
|---------------------------------------|------------------|----|------------------|----|
| f/                                    | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4                                     | Excellent        | 32 | Excellent        | 32 |
| 5.6                                   | Excellent        | 36 | Excellent        | 32 |
| 8                                     | Excellent        | 45 | Excellent        | 36 |
| 11                                    | Excellent        | 40 | Excellent        | 36 |
| 16                                    | Excellent        | 40 | Excellent        | 36 |
| 22                                    | Excellent        | 40 | Excellent        | 32 |

### CONTRAST

| BRONICA ZENZANON 150mm f/4<br>at 30 lines/mm |                  |    |                  |    |
|----------------------------------------------|------------------|----|------------------|----|
| f/                                           | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4                                            | High             | 58 | High             | 29 |
| 5.6                                          | High             | 65 | High             | 36 |
| 8                                            | High             | 66 | High             | 39 |
| 11                                           | High             | 64 | High             | 38 |
| 16                                           | High             | 62 | High             | 28 |
| 22                                           | High             | 47 | High             | 27 |

above average performance.

**Optical bench analysis** (for optical experts only): 65mm f/4: On axis, diffraction-limited pattern by f/8; very slight undercorrected spherical aberration noted at widest apertures. Off axis, slight skew-ray flare mixed with very slight astigmatism; lateral color throughout. 100mm f/3.5: on axis, very slight flare; slight overcorrected spherical aberration, both gone by f/8. Diffraction-limited pattern by f/11. Off axis, very slight skew-ray flare, and lateral color.

150mm f/4: On axis, slight secondary color aberration, slight yellow flare at all apertures; diffraction limited pattern by f/16. Off axis, very slight coma, lateral color throughout. (April 1985)

## MAMIYA M645 SUPER: ADVANCED FULL- SYSTEM 6x4.5 SLR?

### MANUFACTURER'S SPECIFICATIONS:

**Mamiya M645 Super** 2 1/4 x 1 5/8-in. (6x4.5cm) single-lens reflex cameras. **Body No. FD06768. LENS: 80mm f/2.8 N Mamiya-Sekor C in Mamiya M645 bayonet mount. No. 103940. SHUTTER: Horizontal travel, electronically controlled cloth focal-plane with speeds from 4-1/1000 sec. plus B, X ync. at 1/60 sec. mechanical speed. EXPOSURE SYSTEMS: With accessory AE Prism Finder N, aperture-priority TTL auto-exposure with averaging (A), spot (S) and Auto Shift (Auto A-S) modes, plus manual match-diode metering; 3 GPD cells in finder read center-weighted and/or central spot areas of focusing screen; EV 1-19 (at ISO/ASA 100); exposure compensation  $\pm 3$  stops in 1/3-stop increments; exposure hold provision. FLASH: Standard hot shoe and PC contact on body provide X sync at 1/60 sec. and slower speeds. VIEWFINDER: Interchangeable chest-level finder with built-in sportsfinder; user-interchangeable screens; accessory Prism Finder N and AE Prism Finder N; central split-image rangefinder, microprism and fine-focusing collars, full focusing outer area standard screen, with AE Prism Finder N, LED-illuminated numerals indicate camera- and user-selected shutter speeds, meter mode in use, out-of-exposure range warnings. OTHER FEATURES: Interchangeable 120, 220 or 35mm film magazines automatically key ISO/ASA film speed into exposure system; mechanical interlocks prevent blank or double exposures, automatically advance film and/or cock shutter only when needed; accessory Power Drive N powered by 6 AA alkaline or nicad cells provides built-in grip auto first frame positioning and wind-on at end of roll, single advance or continuous shooting at up to 1 frame per 0.8 sec.; built-in battery check, mirror lock-up, multiple exposure controls, six-position adjustable film crank, shutter-release lock, film box end clip and dark slide storage slot, removable soft rubber eyecup and eyepiece blind on AE Prism Finder. POWER: One 6-volt silver oxide SR-44 battery powers shutter timing, metering and other circuitry. PRICE: \$1,385.00 with waist-level finder, film-wind crank and 80mm f/2.8 lens; AE Prism Finder N, \$625.000; Power Drive N, \$310.00.**

When Mamiya conceived the original M645 over 16 years ago, they planned to create a handier, more portable, medium-format SLR for those weaned on 35mm cameras. They also hoped to carve out a niche for themselves among amateurs and pros who wanted the improved image quality of a bigger negative, but a more convenient, less costly camera than existing 6x6cm (2 1/4 in. square) and 6x7cm SLRs. History records that they succeeded far beyond their modest expectations, creating, in effect, a new equipment category—the modern 6x4.5cm SLR system.

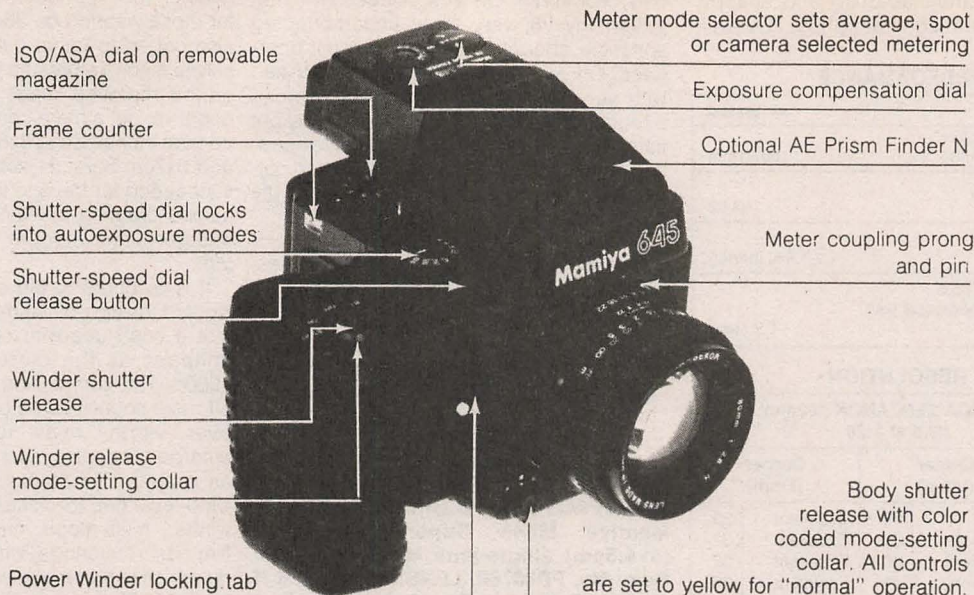
It is a tribute to the soundness and farsighted design of Mamiya's original M645 that it continues with only relatively minor changes as the current Mamiya M645 1000S. The competition has gotten quite a bit more sophisticated over the years, however; worthy rivals to the M645 have emerged, sporting such tempting features as snap-on film backs and a 35mm-style wind-lever grip (Bronica ETRS II) and built-in winder, multi-mode metering, and off-the-film flash metering (Pentax 645). Mamiya's response to these challenges is the new Mamiya M645 Super, a thoroughly modern, modular 6x4.5cm SLR clearly targeted at professionals and advanced amateurs seeking maximum versatility and convenience along with near-35mm handling ease.

Aside from the format and an obvious family resemblance, the M645 Super shares few components or features with its long-lived predecessor, but these include three very important items—the lens mount, Nikon F-style meter-coupling prong, and electronically controlled cloth focal-plane shutter (which now moves horizontally, however). The Super thus shares the lens line of previous M645s, and adds three new lenses of its own, resulting in the most extensive total lens array of any 645 system. Moreover, all these lenses can mount and meter couple to any M645 body fitted with meter-prism. The famous pin-in-prong external coupling system is as reliable as any system going, but you must make sure that the pin in the underside of the meter-prism housing is properly engaged in the prong on the lens aperture ring to avoid metering errors. Likewise, the advantages of the shutter's fast top speed action stopping, shooting with fast films must be balanced against its more limited flash sync speeds (to 1/60 sec.) compared to leaf-shutter cameras. There is, however, a 70mm f/2.8 leaf shutter lens available, offering sync at all speeds.

Operationally, the basic M645 Super (that is, without meter prism or power grip) sports two major advances over earlier models—fully interchangeable film backs (120 and 220 at present plus a 35mm back promised shortly) with automatic film-speed indexing, and an incredible system of mechanical interlocks which virtually preclude the possibility of shooting a blank or multiple exposure without your intending to. The backs and outer body shells are constructed largely of ABS polycarbonate with a judicious sprinkling of metal components (gears, retaining springs, dark slide). The film inserts, which are identical to and interchangeable with those in older M645s, are mostly metal (e.g. pressure plate, side plates, rollers and hinged roll holders), with a few nylon and ABS parts (insert-locking and spool-retaining pins). The actual film



## What's New At A Glance: Mamiya M645 Super



plane is determined by the mating of two precision castings: a metal plate at the back of the main body, which incorporates a rectangular groove framing the shutter curtain, and an ABS plate at the front of the film back, which has a matching ridge that fits into the groove. To mount a film back, position the notch under the stainless steel plate at the bottom of the magazine's front over a steel catch on the bottom of the main body. Next, swing the top of the magazine forward until it engages the hooked retainers on the main body with an audible click. To remove it, insert the dark slide, press down and push on the two-part double lock at the top left-hand front corner of the magazine, and lift it off. It's a one-hand/one-finger operation, but requires such a deliberate touch that it's almost impossible to accomplish accidentally—nice engineering.

Examining the standard 120 film back reveals considerably more ingenuity of design. Its back cover incorporates a convenient dark slide storage slot in addition to the usual film box end clip; its sides have comfortable rubberized finger grips for added security in handling, mounting and removal. The dark slide itself can be inserted either way and has a green line on both sides to let you know when you've pulled it out far enough to shoot a full-frame picture. Atop the magazine is the ISO/ASA dial, covering a film speed range of 25-6400 in 1/3-stop increments, the film speed being keyed into a mounted AE Prism Finder via four gold-plated contacts that mate with a similar pair on the back of the main body when you mount the magazine. On the right-hand side of the magazine is a manual wind knob (for positioning the first frame with the back off the camera) and a film counter near the top which begins at "S," proceeds to "1" and tops out at "15" on the 120 version. Finally, at the upper left toward the rear of the magazine on the left-hand side, there's a two-button (press in top one, then push down bottom one) release that's almost identical to the magazine removal button and succeeds in being equally secure and convenient.

Perhaps the most amazing mechanical *tour de force* to be found on this modern, modular, electronically controlled camera is its integrated system of interlocks. Indeed, it is as close to a foolproof film handling system as we've ever encountered on any interchangeable back roll film camera. There's nothing remarkable about a magazine that can't be removed until you insert the dark slide, or a camera that won't let you shoot until you pull the dark slide out far enough, but the Super does much more. It won't let you shoot a double exposure or a blank exposure without your intending to, and will automatically perform only those functions needed when you "wind to the next frame." For example, if you mount a magazine with a previously exposed frame in shooting position, the camera won't fire until you wind, thus positioning a fresh, unexposed frame in the film aperture. This winding action will cock the shutter/mirror mechanisms only if they weren't previously cocked and will bypass them if they were. If you mount a magazine with an unexposed frame in shooting position, the winding will only cock the shutter/mirror mechanism if needed without moving the film. The only way to make a double (or multiple) exposure is to turn the little knob on the Super's right side from the normal "white dot" position to the orange "multi" mark, which will let you wind, cock and fire the shutter/mirror as many times as you wish without advancing the film. To make a blank exposure you've either got to point the camera at a blank wall or shoot (preferably at a manually selected shutter speed) with the lens cap on.

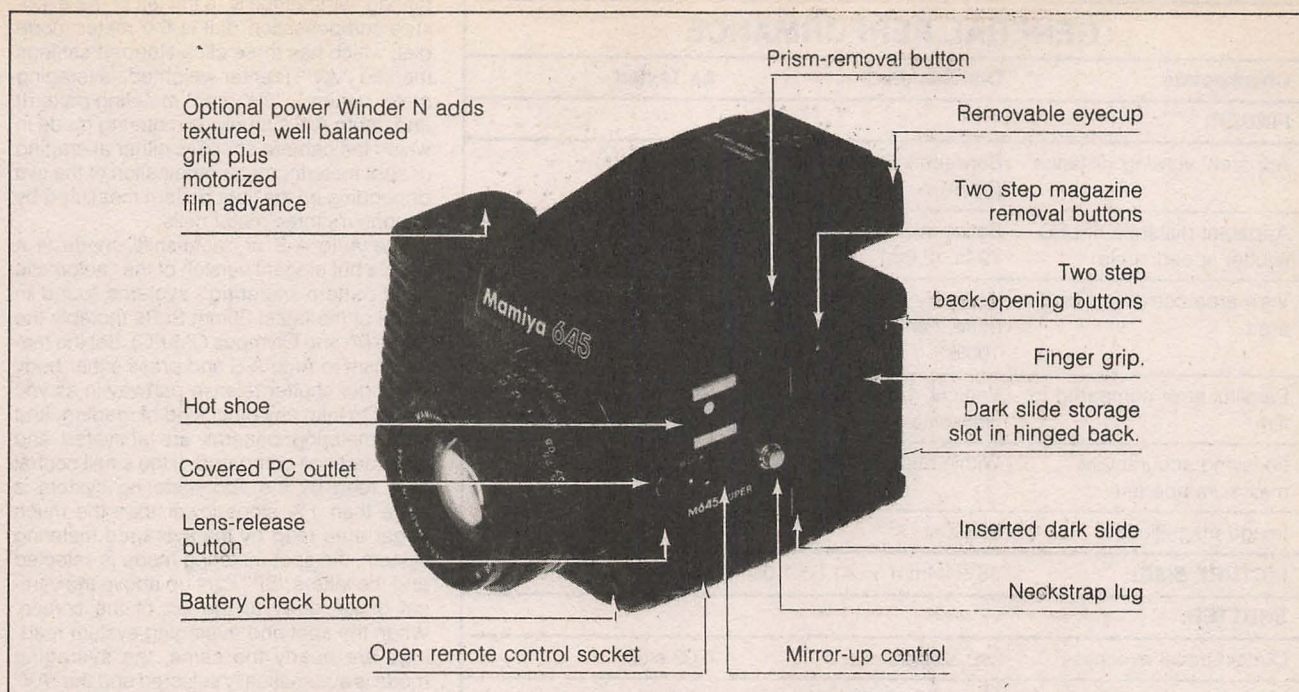
With the standard flip-up chest-level finder and manual film-wind crank installed, the M645 Super is a competent, straightforward machine with a few notable ergonomic touches. Mount the standard 80mm f/2.8 Mamiya-Sekor C (an optically revised version of the same focal-length standard lens on the M645 1000S), hook a finger behind the catch of the collapsible finder and lift, and the hood snaps into viewing position. Press a small button atop the right front section of the erected hood and the inter-

changeable 2 1/2X magnifier with light-excluding frame pops up into viewing position. Position your eye over the magnifier and you can see that the standard screen not only provides a nice, bright, contrasty focusing image, but also has a very complete array of focusing aids—a horizontal split-image rangefinder in the center surrounded by microprism and fine-focusing collars. The outer area of the screen also has a very fine texture, and is excellent for precisely focusing fine details. Equally pleasing is the upward-facing shutter-speed/mode dial to the right of the hood which lets you see its large, legible digits with a swift rightward glance when using the chest-level finder.

Collapse the finder hood by pushing in its hinged sides and folding back the front section. You'll discover that it incorporates a unique (for a 6x4.5cm SLR) extra feature—a built-in wire frame finder. To erect it, swing up the wire frame around the folded finder top, pull back the rear section on its wire rails, and press a tab to swing up the rear peep sight. The field of view corresponds to that of the normal (80mm) lens at infinity. Since the view of the focusing screen provided through the erected chest-level finder is laterally reversed, the addition of a sports-finder makes a lot of sense when you're tracking active subjects, providing they're not too close to the camera (the auxiliary finder has no parallax compensation system).

The Super's fold-out wind crank has also received more than cursory attention from Mamiya's designers. Like most modern cranks, it's removable—just push the little button on its underside forward and lift it off its three retaining studs. However, before you remount the crank, you can orient it to any one of six different positions so at the end of its film advance stroke it is in a comfortable and convenient place. The crank's outer stainless steel mounting plate fits on only one way (with white line on top), but its inner rotating plate has six slots which engage with spring-loaded pins on the end of the camera body's wind-mechanism shaft to provide the adjustability. With the crank re-





moved you can also see a quartet of closely spaced electrical contacts which mate with those on the accessory power winder. The six-way film-wind crank is a clever and useful feature, and the crank's action is quite smooth and predictable. However, we think the small, squared-off rotating knob at the end of the crank is a bit too small. Don't grab it with the tips of your thumb and index finger, but do as many pros do and let it "ride" in the notch at the base of your right-hand thumb.

This logically brings us to one of the Super's most important accessories, the Power Winder. To install it, remove the crank, make sure the multi-exposure control below the right-hand neckstrap lug is set to normal (white dot) position, orient the left-hand side of the winder over the three mounting studs, and push down the locking tab on the front of the winder until it clicks. To remove the winder you must first press the white button below the locking tab before you can move it up—a good safety feature. As you mount the winder, notice the four gold-plated, spring-loaded "information transfer" contacts on its upper left-hand corner, the rotating slotted plate that fits over the finger grips of the multi-exposure control, and the auxiliary multi-exposure switch on its bottom. Also take careful note of its four-point mounting which engages the three studs mentioned earlier, plus the right-hand neckstrap lug. If you think this system constitutes overkill, bear in mind that the Power Winder also functions as a camera grip that must bear the weight of camera, prism, and possibly a long lens. At first glance, it looks as though mounting the Power Grip prevents you from using the right-hand neckstrap lug but it doesn't. Mamiya's engineers have cleverly ground two notches into this sturdy lug—the outer one for mounting the Power Grip; the inner one for attaching the neckstrap. The Power Grip itself is a superbly multi-functional device that transforms the M645 Super from merely a nice-handling 645 SLR into one of the best-handling medium format cameras we've ever used. Indeed, anyone who uses

the camera without the Power Winder/Grip will be missing out on a goodly percentage of its pleasures, and we predict that almost anyone who tries the Winder won't be content to go back to the crank.

As we've implied, the Power Grip is a marvelous camera grip that's automatically contoured to fit almost any sized digits. It's also covered with a wonderfully grippy, soft, textured rubberlike surface front and rear, making it extremely comfortable to hold. Unscrew the coin-slotted chrome retainer on the bottom of the handgrip section, pull the bottom plate down and you'll find that it's an integral battery compartment holding six alkaline or nicad AA cells. The battery insertion (polarity) diagram could be more visible (it's black on black), but the cells slip in easily with no gymnastics required. Slide the loading compartment back in and lock it in place. You can now check the power condition by pushing the spring-loaded ring around the grip's top-mounted shutter release button until the white dot points to B.C. If you've got enough juice, an adjacent red LED will light up.

One of the Power Grip's most endearing features is auto first frame positioning. Open the film back, lift out the film insert and load it in standard, reverse-curl fashion with full spool on top, take-up spool on the bottom. Now bring the arrow on the paper leader to the red delta "start" mark, snap the insert into the back and shut it, set the film speed on the dial atop the magazine and you're ready to go. Press the tab on the ring around the grip's top-mounted shutter button against spring tension until the white dot points momentarily to the word "start," and the motor will whirr for a few seconds as the film advances to frame one. The counter moves from "S" to "1" and the motor stops. As soon as you release finger pressure, the dot on the ring will point to "on" and you can commence shooting—as soon as you shift the dark slide from "magazine removal" position at the front of the magazine to its storage slot at the back.

Keep the Power Grip's shutter button fully depressed and you can run off a full 15-ex-

posure roll in about 12 sec. with fresh batteries at fast shutter speeds—an impressive performance. Press and release the button. The camera will fire and automatically wind to the next frame in about a second. Turn its collar to "off" and the grip's shutter button locks, but you can still shoot (without advancing the film), by pressing the "main" release at the lower right-hand front corner of the camera body, providing its collar is turned to the white dot (normal) or orange dot (manual, mechanical shutter speed of 1/60 sec.) position. Turn it to the red dot (locked) setting and neither the shutter release on the body nor the one on the grip will operate—a good safety feature. The detents on the three-position switch around the body shutter release are quite stiff, but that is as it should be to obviate "accidents." However, we wish there were some way of locking the body release while keeping the one atop the grip functional. We did occasionally lose a frame by brushing an errant finger over the body release with the attached Power Grip turned on.

Perhaps the most significant aspect of the Power Winder N is not to be found in its spec sheet, or even in its claimed ability to advance 80 (with alkaline magnesium batteries), and 70 (with rechargeable nicads) rolls of 120 through the camera under "normal" conditions (frankly we gave up after 60 rolls and see no reason to dispute Mamiya's contention). What this winder succeeds in doing better than any similar device we've used on a roll-film SLR is to transform the camera's handling and balance most dramatically. The winderless M645 Super is a nice handling camera with either prism or chest-level finder in place. Its angled right front side and grippably textured bottom surface contour to your hands beautifully. But the winder-equipped Super is even better. It really does "handle like a 35"—a claim 2 1/4 camera makers have made but few have attained. In fact, equipped with normal lens, AE Prism Finder and Power Winder N, the M645 Super actually handles *better* than many 35s, and feels more comfortable when turned 90° to the left for shooting verticals.



| GENERAL PERFORMANCE                          |                                                                                                                                           |                                                     |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| Checkpoints                                  | Our Standard                                                                                                                              | As Tested                                           |
| FINDER:                                      |                                                                                                                                           |                                                     |
| Apparent viewing distance                    | Between infinity and 20 in. (0.5m)                                                                                                        | 39 in. (1.0m)                                       |
| Apparent distance of LED shutter speed scale | Between 26 in. (0.7m) and 79 in. (2.0m)                                                                                                   | 49 in. (1.2m)                                       |
| View area compared to film area              | Vertically and horizontally more than 90%, less than 100%                                                                                 | Vertical: 95%<br>Horizontal: 94%                    |
| Parallax error compared to film              | Vertical: 1.04mm<br>Horizontal: 1.7mm                                                                                                     | Vertical: 0.2mm (down)<br>Horizontal: 0.4mm (right) |
| Focusing accuracy at maximum aperture        | Within depth of focus                                                                                                                     | No discrepancy                                      |
| Image magnification                          | 0.79X ± .1X                                                                                                                               | 0.80X                                               |
| PICTURE SIZE:                                | 56 ± 1.4mm × 41.5 ± 1.04mm56.4mm × 41.6mm                                                                                                 |                                                     |
| SHUTTER:                                     |                                                                                                                                           |                                                     |
| Curtain travel evenness                      | ± 0.33 stop                                                                                                                               | 0.02 stop                                           |
| Insulation from sync                         | More than 7 megohms                                                                                                                       | Infinity                                            |
| Sync contact efficiency                      | More than 60%                                                                                                                             | 70% (hotshoe)<br>80% (pc)                           |
| Sync delay time                              | X: within full opening                                                                                                                    | Okay                                                |
| Shutter curtain bounce                       | Not allowed                                                                                                                               | None                                                |
| Self-timer delay                             | 7-15 sec.                                                                                                                                 | 10 sec.                                             |
| CAMERA NOISE:                                | 77dB(a), quiet for a 645 reflex                                                                                                           |                                                     |
| CAMERA SIZE:                                 | Body: (with AE prism finder) 4½ in. wide, 4⅞ in. high, 5¼ in. deep (114 × 125 × 134mm)<br>Lens: 1⅓⅞ in. long, 2⅝ in. diameter (46 × 67mm) |                                                     |
| WEIGHT:                                      | Body: 2 lbs. 11⅞ oz. (1244g) with prism finder and batteries<br>Lens: 7¾ oz. (220g)                                                       |                                                     |

When concentrating on a subject or shooting sequences, it is literally possible to believe that you are shooting with a 35mm SLR. When this happened to us, we had to smile as we brought the camera down from eye level and saw what it really was. No, the fully equipped M645 Super is not the lightest or smallest 645 SLR around, but we believe its power grip gives it an edge in overall handling and "feel."

Without a doubt, the Super's most technically audacious major accessory is the AE Prism Finder. Though it incorporates several unique features it can't really be called an "engineering breakthrough," but it embodies so much sound, thoughtful engineering, it qualifies as one of the best meter prisms we've used.

To install it, first unlock the chest-level finder by pushing down on the button near its right, rear corner while pressing in the button near its left, rear corner, then lift it off. On the side of the screen you'll find two separate arrays of seven and five flat gold-plated contacts respectively (a total of twelve), plus three additional gold contacts on the rear of the vertically extended nameplate housing at the front of the screen. When you mount the AE Prism Finder by pressing its front into the housing and its rear section down until it clicks, you can see that each of

these contacts mates with a spring-loaded gold contact on the front or bottom of the prism unit. Like the other two-button locking systems on the Super, the one for top-mounted finder accessories is secure and simple, yet very difficult to unlock accidentally. Why are twelve meter contacts needed to transfer information to and from the AE Prism? Primarily because the prism provides no less than three separate autoexposure modes, plus metered manual mode, exposure hold capability, and a clear but complex system of LED-illuminated finder readouts. All meter and shutter-timing functions are powered by a single 6v SR-44 battery that resides in a clearly marked but "fiddly" battery compartment with a "losable" cover situated on the bottom of the camera.

Once you've added the AE Prism Finder and Power Winder N to the basic M645 Super, you have, in effect, endowed it with the capabilities of a contemporary 35mm automatic SLR. Atop the meter prism, faired in behind the centrally placed nameplate are two clearly marked milled-edge dials. Press in the button on the right-hand dial and you can turn it to set exposure-compensation values ranging from -3 to +3 stops in ⅓EV increments. The "uncompensated" position in the center is denoted with a zero. The dial

placed symmetrically to the left of the exposure-compensation dial is the meter mode dial, which has three click-stopped settings marked "AV" (center-weighted, averaging meter pattern), "SP" (spot-metering pattern) and "Auto A-S," a unique metering mode in which the camera chooses either averaging or spot metering or a combination of the two depending on the light pattern measured by the prism's three meter cells.

The Auto A-S or "auto-shift" mode is a simple but elegant version of the "automatic multi-pattern metering" systems found in some of the latest 35mm SLRs (notably the Nikon FA and Olympus OM-PC). Set the meter prism to Auto A-S and press either body or winder shutter release partway in as you would to take any other kind of reading, and both metering patterns are activated and their readings compared. If the small central area read by the spot-metering system is more than 1½ stops lower than the much larger area read by the averaged-metering system, the spot metering mode is selected and the letters "SP" light up above the vertical digital array to the left of the screen. When the spot and averaging system readings are nearly the same, the averaging mode is automatically selected and the "AV" lights up just above the spot where the "SP" appeared. Finally, when the spot reading is from ¾ to 1½ stops "darker" than the averaging reading, the meter system sets an intermediate value between the spot and averaged readings and both the "AV" and "SP" light up. The fact that the Mamiya's auto-shift mode tells you what it's doing is certainly in keeping with the wishes of most pros and advanced amateurs who want to exercise complete control over the exposure process even while availing themselves of the advantages of autoexposure.

In order to get full automation or through-lens match-diode metering with any of the Super's exposure modes you must use the AE Prism Finder. When fitted with the chest-level or plain prism Finder N, it's a straight manual camera providing an impressive range of electronically controlled shutter speeds (8-⅓, 1000 sec.) but no metering whatsoever. To select manual metering mode when using the meter prism, choose any manual shutter speed and set your metering pattern. When you press either release partway in, you'll now see your selected shutter speed and meter mode indications as red LED-lit characters in the vertical strip to the left of the screen. The digits of the camera-suggested proper-exposure shutter speed will flash continuously if you maintain pressure on the release and the entire display will be visible for 10 sec. after you release finger pressure. If you select a shutter speed below 1 sec. (they're in yellow instead of white on the shutter dial) a red "LT" (for "long time") will light up below the shutter speed array; select "B" and that's what you'll see in the finder. To meter manually, turn either the aperture or shutter-speed dial (or both) until you see a single, continuously lit shutter speed. You can't set intermediate shutter speeds in manual mode, but you can meter exposure differences as small as ⅓ stop by turning the aperture dial in between its full-stop detents—a boon to persnickety pros who demand metering systems with fine discrimination. We are pleased to confirm that the system can set differences as fine as ⅓ stop in the autoexposure modes.

To set the AE Prism-equipped camera for



autoexposure, turn the shutter dial to the red "dot-in-circle" mark just past the 1000 (1/1000 sec.) setting, select any f/stop you wish by turning the aperture ring at the rear of the lens barrel, and press either shutter release partway in to display the camera-selected shutter speed in the finder. If even the slowest shutter speed can't provide an accurate exposure for the lighting conditions at your chosen aperture, the "LT" at the bottom of the shutter-speed display will flicker rapidly; if there's too much light for even the fastest shutter speed the word "over" flashes rapidly above the 1/1000 sec. readout position. If only the meter mode indication(s) and a usable shutter speed appear you're free to take the picture by pressing the shutter button all the way in.

The meter prism also provides an autoexposure lock, which you select by turning the camera's shutter speed/mode dial from dot-in-circle (auto-exposure) to dot-in-rectangle (AE lock) position. To hold an exposure reading, align the most important part of the subject in the center of the finder, press either shutter release partway in and hold it there. As long as the release is held in, the exposure reading will be memorized and the finder display will not change as you alter the position of the camera. As with other such systems, Mamiya's AE Lock lets you make more precise exposure readings quickly and easily without leaving the autoexposure mode. However, you must remember that you've switched to AE lock mode or you risk making exposure errors—there's no AE Lock indication in the finder other than the fact that the readouts don't change when the light does.

We are in general agreement with the AE Prism Finder N instruction manual that states "Although the AE Lock can be used with either (it should say *any*) metering mode, it is most effective with spot metering." We also concur with Mamiya's well thought out "shutter-speed-dial lock" which lets you turn the dial freely to any setting until you reach the autoexposure or AE lock positions, at which point it locks in, and you can't turn to any manual speed setting unless you press in a little button at the front of the dial while turning it. This may strike you as a bit of a nuisance, but it minimizes metering mistakes and forces you to remember your meter mode.

Once you press the shutter release all the way in, the mirror flips, the shutter fires, and the mirror returns to the accompaniment of a satisfying, low-pitched "clunk" at instantaneous speeds. With the motor attached, its "clunk-whirr" produces a longer, higher-pitched sound that's less than 1 dB louder. Without the motor, the M645 Super is much quieter than other focal-plane shutter, medium-format SLRs and a fair match for many leaf-shuttered models.

To sum up, we liked the Super's Meter Prism very much indeed, and we commend it highly to all photographers—pros included—who are attracted to the camera. In addition to its aforementioned virtues, it balances beautifully with the winder-equipped camera, is reasonably light and compact, its right side is contoured to clear the big shutter dial, its removable, squared-off eyecup is extremely comfortable, and it's got a built-in eyepiece blind (useful for obtaining the correct exposure in AE modes with your eye away from the finder) that shows red in the eyepiece so you know

when it's deployed. Eyeglass wearers can see almost the entire viewing area when using the prism, and non-eyeglass wearers can see the entire screen plus all adjacent readouts in a single glance.

It should be clear from our many favorable comments that we think very highly of the M645 Super, both as an overall system, and in its multitude of individual features that combine to produce one of the handiest, most convenient SLRs in its class. The lab test data on these pages confirm the fact that its exposure, shutter and optical systems deliver a level of performance second to none.

The Mamiya M645 Super is a beautifully executed, rugged, professional caliber machine that's been carefully designed for easy maintenance. Are there any further brickbats among these many bouquets? Just two. We wish the Super had TTL flash capability like its arch rival, the Pentax 645, and we wish its normal lens focused a bit closer than 0.7m, (2 3/4 ft.), which will get you a head-and-shoulders portrait of an adult, but not a frame-filling head shot. However, when you consider its many examples of thoughtful—even brilliant—engineering, its superb handling and balance, and the seamless way it functions as an integrated system, it becomes clear that the positive points predominate. Anyone contemplating taking the "great leap" into a 645 system should, as the saying goes, "give this camera serious consideration." (September 1986)

## MAMIYA-SEKOR 55mm f/2.8

**Specifications:** 55mm f/2.8 Mamiya-Sekor No.105425 in Mamiya bayonet mount, accepts 58mm accessories; f/2.8 to f/22, full-stop increments, automatic/manual selector lever; min. foc. dist. 1.5 ft. (.45m); 2 9/16 in. long, 2 9/16 in. diam. (60 x 66 mm), 10 11/16 oz. (304 g). Price: \$545.00.

**Practical comments:** Relatively compact retrofocus wide-angle, satin-black finish with green engraved focal length settings, white metric and aperture scales, footage in yellow; 5/8 in. rubber-like patterned foc. ring distance focuses from infinity to close foc. distance in 90 degree ccw turn. Apertures clicked at full stop intervals were widely and evenly spaced. External Nikon-type diaphragm coupler engages automatically.

**Field test slides:** Transparencies crisp with detail well-rendered. Slight softness noticed in corners, gone 2 stops down. Corners equalled center sharpness by f/5.6. Flare well-controlled. Overall performance average to above-average for a medium format, wide-angle.

**Optical bench analysis:** On axis, very slight under-corrected spherical, very slight red flare gone by f/8, diffraction limited by f/16. Off-axis, very slight coma, mixed with very slight skew-ray flare. Minimal lateral color present. (September 1986)

## MAMIYA-SEKOR 80mm f/2.8

**Specifications:** 80mm f/2.8 Mamiya-Sekor No.103940 in Mamiya bayonet mount, accepts 58 accessories; f/2.8 to f/22, full-stop

### PERFORMANCE

| Our Standard                                                                      | as Tested     |
|-----------------------------------------------------------------------------------|---------------|
| <b>Focal length: ±5%</b><br>( 52.25- 57.75mm)                                     | 55.05mm       |
| <b>Aperture: ±5%</b><br>(f/2.66-2.94)                                             | f/2.80        |
| <b>Distortion:</b><br>(±1.5%)                                                     | 0.8% (barrel) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>(0-1.4 stops) | 1.1 stops     |

### RESOLUTION

| MAMIYA-SEKOR 55mm f/2.8<br>at 1:20 |                      |    |                      |    |
|------------------------------------|----------------------|----|----------------------|----|
| f/                                 | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 2.8                                | Excellent            | 63 | Excellent            | 50 |
| 4                                  | Excellent            | 69 | Excellent            | 57 |
| 5.6                                | V. Good              | 69 | Excellent            | 63 |
| 8                                  | Excellent            | 80 | Excellent            | 63 |
| 11                                 | Excellent            | 80 | Excellent            | 69 |
| 16                                 | Excellent            | 69 | Excellent            | 63 |
| 22                                 | Excellent            | 63 | Excellent            | 57 |

### CONTRAST

| MAMIYA-SEKOR 55mm f/2.8<br>at 55mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 2.8                                                  | High       | 45 | High       | 38 |
| 4                                                    | High       | 52 | High       | 43 |
| 5.6                                                  | High       | 58 | High       | 49 |
| 8                                                    | High       | 61 | High       | 50 |
| 11                                                   | High       | 56 | High       | 48 |
| 16                                                   | High       | 45 | High       | 38 |
| 22                                                   | High       | 40 | High       | 32 |

### PERFORMANCE

| Our Standard                                                                      | as Tested     |
|-----------------------------------------------------------------------------------|---------------|
| <b>Focal length: ±5%</b><br>( 76.00- 84.00mm)                                     | 81.90mm       |
| <b>Aperture: ±5%</b><br>(f/2.66-2.94)                                             | f/2.86        |
| <b>Distortion:</b><br>(±2%)                                                       | 0.5% (barrel) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>(0-1.2 stops) | 1.1 stops     |

### RESOLUTION

| MAMIYA-SEKOR 80mm f/2.8<br>at 1:20 |                      |    |                      |    |
|------------------------------------|----------------------|----|----------------------|----|
| f/                                 | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 2.8                                | Excellent            | 63 | Excellent            | 56 |
| 4                                  | Excellent            | 69 | Excellent            | 63 |
| 5.6                                | Excellent            | 69 | Excellent            | 63 |
| 8                                  | Excellent            | 79 | Excellent            | 69 |
| 11                                 | Excellent            | 79 | Excellent            | 69 |
| 16                                 | Excellent            | 69 | Excellent            | 63 |
| 22                                 | Excellent            | 63 | Excellent            | 56 |

### CONTRAST

| MAMIYA-SEKOR 80mm f/2.8<br>at 80mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 2.8                                                  | High       | 48 | High       | 36 |
| 4                                                    | High       | 54 | High       | 41 |
| 5.6                                                  | High       | 61 | High       | 49 |
| 8                                                    | High       | 63 | High       | 52 |
| 11                                                   | High       | 57 | High       | 48 |
| 16                                                   | High       | 49 | High       | 42 |
| 22                                                   | Medium     | 41 | Medium     | 34 |



## 2 1/4 Single Lens Reflex

detents. Auto-manual selector lever. Min. foc. dist. 2.25 ft. (0.7 m), 1 11/16 in. long, 2 5/8 in. diameter (43 x 67 mm), 7 3/4 oz. (220g). Price: \$325.00.

**Practical comments:** Compact, satin-finished black lens mount marked for focal length, most scales legible in white, footage scale in yellow; 5/16 in. wide rubberlike, patterned focusing ring goes from infinity to min. foc. distance in 90 degree, ccw turn; Apertures clicked at full-stop intervals but wide and equal spacing permitted accurate intermediate settings. Nikon-type external diaphragm coupler engages automatically.

**Field test slides:** Transparencies crisp and snappy with detail well-rendered. Corners equalled center sharpness by f/4. Flare is well-controlled throughout. Rates above average for a medium format, fast normal lens.

**Optical bench analysis:** On axis, very slight under-corrected spherical aberration, very slight axial color, gone by f/11. Diffraction limited by f/16. Off-axis, very slight skew ray flare mixed with very slight astigmatism. Minimal lateral color present.

## MAMIYA RZ67: BRAND NEW CLASSIC

**MANUFACTURER'S SPECIFICATIONS:** Mamiya RZ67 2 1/4 x 2 3/4-in. (6 x 7cm) single-lens reflex camera. Body No. H100162. **LENS:** 110mm f/2.8 Mamiya-Sekor Z in interchangeable bayonet mount, apertures to f/32, focusing to 1 ft., 9 in. (53cm); accepts 77mm threaded accessories. **SHUTTER:** Electronically-controlled Seiko #1 leaf type in each lens with speeds of 8-1/400 sec. plus B and T, powered by 6v silver-oxide or alkaline battery in body, mechanical shutter speed of 1/400 sec. usable without battery X sync. **VIEWING:** Interchangeable waist-level finder with light-excluding hood, built-in magnifier, user-interchangeable viewing screens; standard screen has central fine matte spot surrounded by full-focusing, fine-Fresnel-pattern outer area; automatic finder masking system indicates picture area for vertical or horizontal orientation of revolving back. **OTHER FEATURES:** Interchangeable 120 and 220 film magazines incorporate ASA 25-6400 dials and electric contacts for automatically keying film speeds into optional match-diode-metering PD Prism Finder and other meterized finders; arrays of contacts on back of each lens, in camera body, and adjacent to focusing screen relay shutter speed, aperture, and other information among camera controls, interlens shutters, interchangeable backs and optional meter prisms to provide through-lens match-diode and aperture-preferred metering options, film-advance completion and dark-slide-in warnings to finder; built-in mechanical interlocks prevent lens removal without cocking shutter, film magazine removal without inserting dark slide; multi-function lever on side of body selects multi-exposure setting, releases revolving back for vertical or horizontal framing; combined film wind/shutter cocking lever on right-hand side of body advances film to next frame in single 114° stroke; focus lock; shutter-

release lock; accepts Mamiya RB67 lenses and finders directly, RB67 film holders by means of G Adapter RZ, electronic, two-channel remote release, motor winder, Polaroid back. **PRICE: \$1980 with 110mm f/2.8 lens and standard waist-level finder.**

When Mamiya Camera Co. released the original RB67 back in 1970, it created something of a photographic legend. For over a decade this rugged, professional workhorse of a 6 x 7cm SLR has persisted in virtually unaltered form. (The Professional S model, which debuted in 1974, added only two major improvements: double-exposure prevention and finder indications for horizontal and vertical formats.) As we originally predicted, the natural habitat of this relatively large and heavy machine is and has been the studio, but those pros and advanced amateurs intrepid enough to tote it have found it to be a superb field camera also.

Indeed, the RB67 is such a nice, reliable, versatile, all-mechanical camera that some conservative professionals are bound to greet its all new, totally redesigned, mostly electronic stablemate with some degree of skepticism, if not outright hostility. Well, they needn't worry. The timeless virtues that have made the RB67's enviable reputation remain fully intact on the new RZ67. And virtually every major and minor change incorporated in the RZ is a change for the better that results in easier operation, better performance, and even greater versatility. In short, we believe that the Mamiya RZ67 is one of the finest, most intelligently designed and brilliantly executed medium-format professional cameras we have seen—a veritable classic in its own time. Let's take a closer look at the machine that can generate such enthusiasm.

Despite its thoroughly modern, radically revised status, the new RZ67 is easily identifiable as the lineal descendant of the venerable RB. It is still a rather large, hefty (6 x 7cm) SLR with an interchangeable film magazine on the back, a collapsible waist-level (actually chest-level) finder on top, and a rugged, double track, rack-and-pinion focusing mechanism which moves the massive, squarish front standard in and out by turning one of the large (1 1/8-in. diameter), knurled focusing knobs. (As before there's one on the right and one on the left side of the camera.) Behind the front standard is another time-honored and effective device—a large, square-section bellows which allows the RZ's lenses to move forward 46mm (1 7/8 in.) for close focusing while adding very little weight to the camera itself.

Other similarities between the new RZ and the old RB abound, and in general Mamiya has followed a conservative, nonobsolescent design philosophy with respect to the RZ's mechanical components. For example, top-mounted accessories such as finders and meter prisms snap on pretty much as before, and most old and new top-mounted accessories will fit either camera. And while the lens mount throat has been considerably widened (by 7mm) on the RZ to enable the optical designers to come up with faster lenses with improved overall sharpness and evenness of illumination, RB lenses will fit and function perfectly on the RZ, albeit without coupling electronically to its meter finders.

Nor has the back end been forgotten—RB roll film magazines will mount on the RZ by means of a simple adapter dubbed the G

Adapter RZ. However, the complex adapter system needed to mount both ordinary and specialized film holders on the RB has been replaced by a much simpler and more convenient direct-mounting system that Mamiya calls the "G Lock System." While RZ lenses will not mount on the RB (there'd be no way of powering the shutters even if they did!) they're still attached and removed by turning a large breech-lock bayonet ring at the back and couple mechanically via two sturdy metal pins running in arc-shaped slots at the back of the lens, so an RB owner will feel right at home with the RZ and vice versa. Ditto for photographers used to cocking the shutter and returning the mirror to viewing position by pressing forward on the RB's large, nearly vertical, side-mounted lever with their right thumb. They'll find that the RZ's similarly placed lever "falls readily to hand" and has the considerable advantage of performing both aforementioned operations *plus* winding the film to the next frame in one amazingly smooth 114° stroke.

As long as we've begun by examining the RZ's mechanical components, let's take a more detailed look at them, with an occasional glance back at the RB to see how they've been updated and refined. Obviously, the major mechanical advance (no pun intended) built into the RZ is combined film wind and shutter cocking. (The RB Pro S has double-exposure prevention plus automatic frame counting and film stop, but you must wind the film in a separate manual operation via the film-advance lever atop each RB film magazine.) To see how the RZ's ingenious system works you need to remove the film magazine to gain access to the coupling gears. To do this pull the stainless-steel dark slide out of its much appreciated storage slot at the back of the magazine and slide it into position between the two vertical white lines on the right-hand side of the magazine. Now slide the black "G Lock" tab on the bottom of the magazine to the right and lift the magazine off the body. What happens if you lose the dark slide, you ask? You can still remove the magazine, but you've got to push a small silver tab next to the main locking control to the left *while* you push the aforementioned black tab before you can unlock it—a neat "fail safe" feature.

With the back removed several things become quite clear. First of all, the RZ magazine itself is conceptually quite different from the RB's. Instead of mounting on a removable, rotatable back section that usually stays on the camera, the RZ magazine turns on a thin metal ring built into the back part of the camera body. This ring has four metal studs which fit into matching receptacles on the front of the RZ magazine and lock it firmly to the camera when the locking tab is pushed toward the left as indicated. These receptacles are part of a round, raised lip that fits into a curved slot on the camera back, forming an effective lightproof barrier. On the left side of the magazine's back (when it's mounted on the camera) are two sets of four gold-plated contacts. Whether the magazine is in a horizontal or vertical position one of these sets of contacts mates with a corresponding set of spring-loaded gold contacts on the back of the main body to transfer set film speed, dark slide position, and shutter status info into the finder and/or meter.

To understand how the film is wound while the shutter is being cocked, direct your attention to the right side of the camera back with the

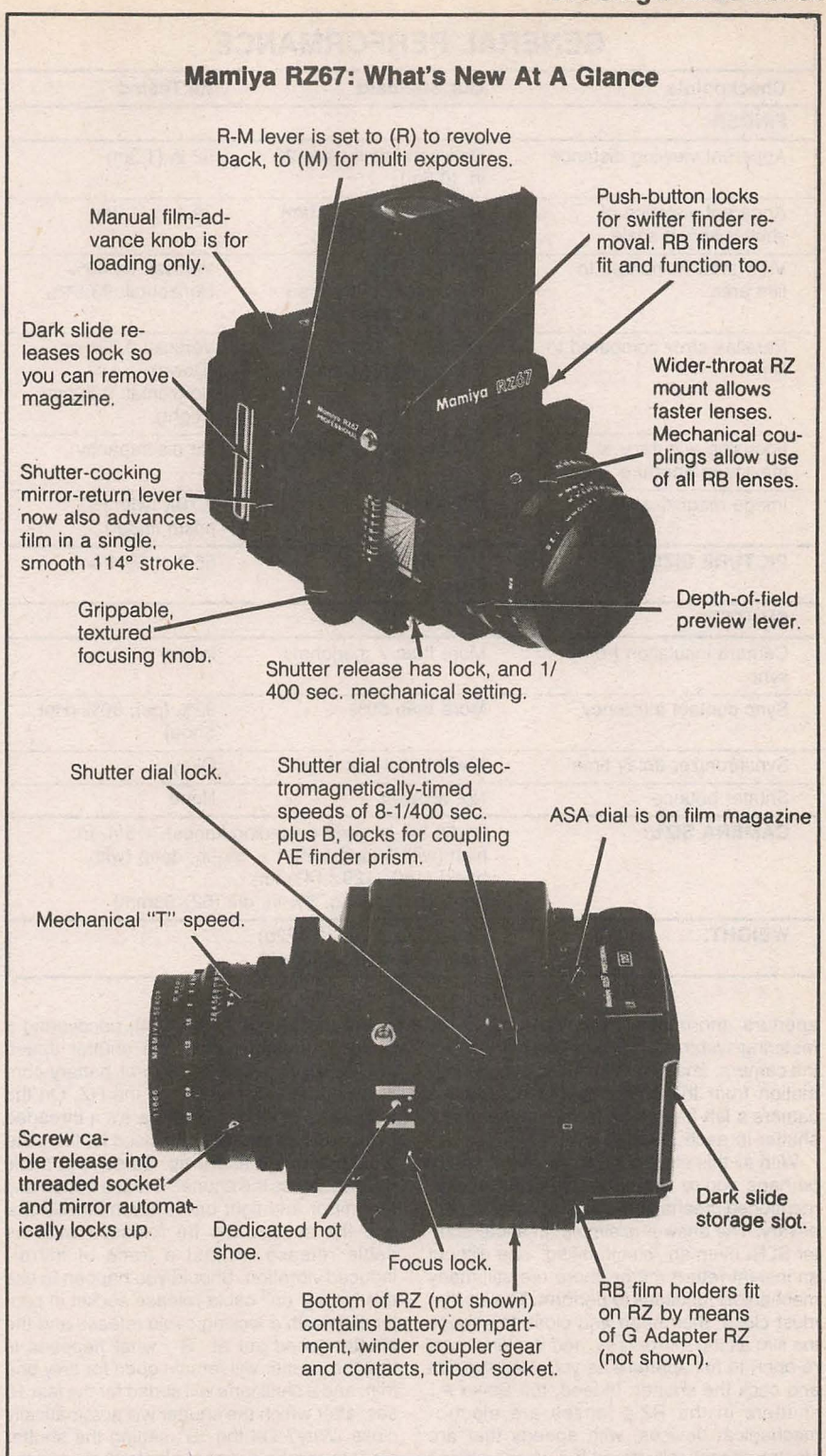


the film magazine off. At both upper and lower right-hand corners you'll find a small, round spring-loaded coupler with a pair of engaging nubs on its outer surface. Move the wind lever forward and both these couplers turn quite rapidly in a counter-clockwise direction. In fact, if you grab one of the couplers and turn it manually the other one will turn also, since they're both geared together internally. Directly forward of the top-most coupler, on the right side of the camera, is a multi-functional control lever with three click-stopped settings. When the lever is at the central position, denoted by a white dot, the couplers stand proud of the camera back and will engage with a cross-slotted connector at the front of the film magazine when you mount it. Push the lever forward to "R" position and the couplers both move in so you can freely rotate the mounted magazine to horizontal or vertical position. Push it back toward the "M" marking and the couplers move in and stay there as you wind the film-advance lever, so you can cock the shutter without advancing the film and take as many pictures as you would like on a single frame. Why are two couplers necessary? That's the simple-but-ingenious part. When the film magazine is in horizontal position its cross-slotted, film-wind connector engages with the top coupler on the camera back; when it's set in the vertical position, it engages the bottom coupler so the film will be properly advanced in either position. The cross-slotted connector is geared to the film-advance shaft by a bevel gear, and the whole gear train worked faultlessly throughout our test.

You might expect that a system which would advance the film while cocking the shutter would require more finger pressure, but this is, happily, not the case—it feels about the same as the old RB's shutter-cocking lever, which does not connect to the film transport system at all.

Let's now remove two other detachable components to get some further insight into the RZ's electronic information transfer system. First we'll lift off the finder hood by pushing in the blue release buttons on either side of the nameplate and sliding it forward. All RZ finders have a pair of mounting tabs at the rear which engage matching slots behind the viewing screen, and a pair of catches at the front which hook onto metal studs in front of the screen. Indeed, the sole mechanical difference between the RB and RZ finder locking systems is that with the former you unlock the finder by sliding the entire nameplate to the right instead of pushing in two buttons. As mentioned, finders are interchangeable between RZs and RBs, although you will understandably lose any electronic benefits of an RZ finder when you mount one on an old model RB 67.

With the RZ's finder removed you can get a good look at the staggered array of 13 flat gold contacts to the left of the finder screen. These mate with a matching set of spring-loaded gold contacts on the underside of any RZ-series meter prism (such as the match-diode-metering PD Prism Finder we tested) and relay quite a bit of information among the camera's aperture and shutter-speed controls, the film magazine, and the meter prism's metering circuits. The standard screen unit is easily removable—just hook a fingernail under the tab emerging from its right-hand side and push forward and upward and the screen detaches from its right-hand retaining catch, so you can hinge



it upwards and lift it off its two left-hand retaining catches. Alternative screens include checkerboard pattern (A4), rangefinder spot (Type B) central microprism (Type C), cross hair (Type D) and rangefinder spot/microprism collar (Type E). All are literally a snap to install.

Let's leave the finder off and direct our attention to the lens mounted on the RZ's front. Presuming the shutter is cocked, grab hold of the nice wide (1/2 in.) knurled rubber collar at the rear of the lens, turn it about 50° counterclockwise and lift the lens off the body. Immediately inboard of the circular cut-out in the front standard—at about 8, 12, and

4 o'clock—are the massive lugs of the RZ's beautifully machined chrome-on-brass bayonet mount. At the sides of the metal channel just inboard of the actual bayonet are two arc-shaped slots, behind which is a plate containing round recesses. Each recess "runs" in its own slot, and when the lens is mounted, the spring-loaded fingers at the back of the lens engage the recess to couple the lens to the body mechanically. Finally, at the bottom of the camera's lens mount there's an array of 12 spring-loaded gold contacts that mate with a similar array of flat contacts at the back of each lens when the lens is mounted. These are used to relay



## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                                                                | As Tested                                             |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                                                             |                                                       |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                                                          | 52 in (1.3m)                                          |
| Apparent distance of shutter-speed scale | Between 157 in (4.0m) and 31.5 in (0.8m)                                                                                                                    | 39.4 in (1.0m)                                        |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                                                                   | Vertical: 94.30%<br>Horizontal: 93.51%                |
| Parallax error compared to film          | Vertical: 1.60mm<br>Horizontal: 2.25mm                                                                                                                      | Vertical: 0.30mm (Down)<br>Horizontal: 0.30mm (Right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                                                                       | No discrepancy                                        |
| Image magnification                      | 0.81X±0.1x                                                                                                                                                  | 0.78X (with PD prism finder)                          |
| <b>PICTURE SIZE:</b>                     | 56±1.5x<br>69.5±1.7mm                                                                                                                                       | 56.2 × 69.4mm                                         |
| <b>SHUTTER:</b>                          |                                                                                                                                                             |                                                       |
| Camera insulation from sync              | More than 7 megohms                                                                                                                                         | Infinity                                              |
| Sync contact efficiency                  | More than 60%                                                                                                                                               | 92% (pc), 86% (Hot Shoe)                              |
| Synchronizer delay time                  | X:within full opening                                                                                                                                       | Okay                                                  |
| Shutter bounce                           | Not allowed                                                                                                                                                 | None                                                  |
| <b>CAMERA SIZE:</b>                      | Body: 5½-in. wide (including knobs) × 5½-in. high (with folded finder) × 5¼-in. deep (with back) (140×129×147mm)<br>Lens: 2⅞-in. long, 3⅝-in. dia (62×93mm) |                                                       |
| <b>WEIGHT:</b>                           | Body: 4 lb. ¼ oz. (1822g)<br>Lens: 1 lb. 5⅝ oz. (614g)                                                                                                      |                                                       |

aperture information from the lens to the metering system via the contacts at the top of the camera, and to relay shutter-speed information from the shutter-speed dial on the camera's left-hand side to the interlens leaf shutter in each Z-series lens.

With all this electronic information transfer perhaps you're wondering why the above-mentioned mechanical coupling is even necessary. The answer is simple: In a leaf-shutter SLR, even an "electronified" one without an instant-return mirror, there are still many mechanical functions to perform. The shutter must close, then open and close to expose the film as the mirror fires, and the lens must re-open to full aperture as you wind the film and cock the shutter. Indeed, the Seiko #1 shutters in the RZ's lenses are electro-mechanical devices, with speeds that are electromagnetically timed but whose blades are actually moved by good old springs in tension. It is the RZ's mechanical coupling system, closely resembling the old RB's, which sequences and executes these vital functions and, incidentally, allows the direct use of RB-series lenses with their all-mechanical shutters.

Before we remount the 110mm f/2.8 Mamiya-Sekor Z normal lens let's examine it. In general, its controls are laid out quite similarly to those on RB lenses except for the absence of any shutter-speed dial. Atop the barrel, in front of the improved, more grippable lens locking ring, there's a standard PC socket and a sliding "T" control. The latter provides a mechanically-held "T" setting

when you slide it to the right, uncovering a white T, irrespective of the shutter speed you've set. It's one of several battery-conserving features present on the RZ. On the left side of the lens barrel there's a threaded cable-release socket that's used for firing the shutter with the mirror up. Screw in a cable release, press the shutter-release button and the mirror and light baffle automatically rise and the shutter can be released with the cable release without a trace of mirror-induced vibration. Should you happen to use this "mirror up" cable release socket in conjunction with a locking cable release and the shutter-speed set at "B", what happens is that the shutter will remain open for only one min. and a shrill tone will sound for the last 10 sec. after which the shutter will automatically close. Why? On the "B" setting the shutter blades are held open electromagnetically and this automatic timing circuit prevents you from wasting a battery. Also in front of the lens locking ring, at the lower right-hand area in shooting position, is the spring-loaded depth-of-field preview tab, which is virtually unchanged from the one on RB lenses, and just as simple and effective.

The middle ring on RZ lenses is the aperture ring, and its knurled edge is wider and more coarsely knurled than the ones on most RB lenses. As before, the three standard lenses we tested all stop down to f/32, but unlike RB lenses they're click-stopped at whole-aperture intervals with no detents at the half-stop settings (more about that when we get to the PD meter prism). However, the

aperture scales are certainly super-legible in light yellow on matte black. Directly in front of the aperture ring there's a blue plastic depth-of-field ring which is read out in conjunction with a dual aperture scale atop the front-most ring. It has been thoughtfully provided with dual scales for footage or metric hyperfocal distances and depth-of-field calculations, and there are even detents at both ends of each scale so you don't accidentally turn the ring 180° and wind up calculating in the wrong units with a possible disaster.

So far we've left only two sides of the RZ67 unexamined—the left-hand side and the bottom. The most important control on the left side is the large, (1⅞-in. diameter), knurled shutter-speed dial that's conveniently located just below the left side of mounted finders, near the top of the camera. It's got shutter-speed settings from 1/400 sec., to 1 sec. in white-on-black, 2, 4, and 8 sec. timed speeds in yellow-on-black, B in red-on-black, plus a red dot-in-circle setting that locks the shutter-speed dial at that position unless you push in a button on the side of the dial while turning it to one of the other settings. The purpose of this locking setting becomes clear when you mount the soon-to-be-available aperture-preferred, auto-exposure meter prism (not tested). When using the AE prism in manual mode, shutter speed selection is thereby transferred to the shutter dial on the right-hand side of the prism housing. In auto mode once you set the locking shutter setting, the camera chooses and sets the proper-exposure shutter speed depending on the film speed and aperture you've selected (and the lighting conditions), and reads it out via LEDs in the auto-exposure prism.

At the lower, front portion of the RZ's left side are one traditional control and another electronically updated element. At the very bottom is the left-hand focusing knob and the lever which locks it at the set position when you push it forward as far as you can. The focusing knob's knurled surface is rubberized (as is its mate on the camera's right side) and it affords a much better grip than its more deeply knurled, plastic-surfaced counterpart on the RB67. The locking lever on the RZ is a virtual dead ringer for the one on the RB67 Pro S, and it serves the same main purpose—preventing "focus creep" when the camera is held in an upward- or downward-pointing position. An inch or so above the left-hand focusing knob is the RZ's dedicated hot shoe, with a central flash contact and two additional smaller contacts toward the rear. In addition to providing a hot shoe, a feature lacking on the RB67, Mamiya's dedicated hot shoe provides a flash ready signal in the finder when using Mamiyalite MZ-series flash units. Using Mamiyalite units has an additional benefit—two units can be fired simultaneously by connecting one unit to the hot shoe, the other to the PC sync terminal.

Turn the RZ over and you'll find an equally fascinating array of components and controls on the bottom. Up toward the front of the camera is the tripod socket (⅝-in. European type with screw-in ¼-in. adapter for the U.S. market) flanked by locating holes for the RZ Winder and other bottom-mounted accessories. Near the middle, on the right-hand side is a circular array of 6 gold contacts which mate with a similar array of spring-loaded pins on the winder's top surface. On the left-hand side of the bottom, near the middle, there's a sliding cover that reveals a winder-coupling gear when you slide the cover in the



direction of the arrow, and behind that is the battery compartment. Insert your fingernail in the slot and pull, and the integral, hinged cover pops up revealing a 6-v battery with its handy "pull-out" ribbon. The compartment cover is legibly keyed for polarity, and the little battery lurking inside powers the shutter-timing circuitry in the body, the metering circuitry in mounted meter finders and the three "monitor lamp" LEDs at the bottom of all finder screens, which we'll get to a bit later.

The time has now come to load up the camera and take some pictures. First we'll load the mounted film magazine by opening both locks on its right-hand side (the RB mag has only one lock near the bottom) and lifting out the film insert. Although the RZ insert loads in the same manner as the RB's (insert fresh roll in the left-hand chamber; pull paper, black side out, around the front-mounted, spring-loaded pressure plate; thread paper leader onto empty spool in the right-hand chamber and wind the film until the arrow on the paper backing coincides with a delta at the bottom of the left-hand chamber) some notable improvements can be seen. Happily, the RZ inserts retain the "spool-holder depressor" buttons which greatly facilitate inserting and removing the spools, but the RZ's pressure plate has been widened, as have both adjacent rollers, in the interest of improved film flatness and (possibly) smoother film transport.

With the film insert properly loaded, you now set the film speed on the little dial atop the mounted part of the film mag, reinstall the insert, push the hinged back section closed and lock both locks. Now, with the film-advance-mode lever in normal position, wind the film-advance lever a few times until it stops and the film counter atop the left-hand end of the film mag will read "1". To open the standard folding hood just grab the back of the top section and flip it up, thus erecting the hood, and move a small, ridged tab at the upper right-hand corner of the erected hood to flip up the light-excluding magnifier.

When actually taking pictures, the RZ67's ergonomically correct layout is a pleasure. The major controls—aperture ring and shutter-speed dial—are easily visible by glancing down, and the separation of function is admirable, with the left hand being used to change shutter speeds, the right hand being used to change apertures and to wind the film, and either hand being used for focusing. The focusing screen, while noticeably brighter than the RB67's, is also commendably contrasty and subject details snap into focus in a most reassuring manner. Complementing the excellent control placement is the RZ's overall balance and feel which can only be described as excellent for a camera of this size. The new textured plastic material used to cover the RZ's body affords a good grip as well as a neat, up-to-date appearance, and the similar looking rubberized covering gracing the bottoms of both sides and the sides of the film magazine is practically "unslippable" even when you grab it with sweaty hands. We also admired the swift but very secure neckstrap attachment system, which is one of the few that's easy to remove when necessary, and the woven nylon strap itself, which is broad in the right places and doesn't dig into your shoulders. Our only criticism concerns, oddly enough, the top surface of the folded finder hood. When being toted, the camera wants to hang most comfortably with its lens pointing upwards and the top of the

folded hood against your body, and the top of the finder hood is plain, flat, matte black plastic, save for two inset rubber strips. If you're fond of metal tie clips, blazer buttons, etc., this top can easily be scratched as we discovered. If it were up to us, we'd cover the folding finder top with a square of texturized plastic material like that affixed to the sides of the RZ.

Another nice thing about shooting pictures with this camera is the ultra-smooth electromagnetic shutter release. Unlike many such devices, the RZ's is mechanically as well as electronically almost perfect, with a very light and predictable amount of slack before the shutter fires and a wonderfully smooth release action. Yes, it's also got a lock, actuated by a knurled collar and an alternative mechanical release position (set collar at orange dot) which works sans battery power, albeit with slightly greater finger pressure. Undoubtedly, part of the smooth-firing impression is attributable to the RZ67's greatly improved mirror-and-baffle-flipping mechanism which is truly uncanny in its lack of shake-inducing vibration.

Then there are the viewfinder surprises—all pleasant ones. Though the standard collapsible finder is meterless, there are three LEDs visible at the bottom edge of the finder screen, near the center. Toward the left there's a round, orange LED that lights to warn you that you haven't cocked the shutter. Unless you're in multi-exposure mode it's also a pretty reliable indication that you haven't wound the film. In the middle is a square, red LED that lights up if the dark slide is inserted in the film magazine. Finally, toward the right is another round orange LED that lights up when an attached Mamiyalite dedicated flash unit has recycled. You have to lightly press the shutter release to see the first two of these handy warning signals.

Now let's have some real fun and mount two of the many accessories that transform the RZ into a genuine professional medium-format system. First there's the winder, a rectangular box that's 3 3/4-in. wide, 3 3/4-in. long, and 1 5/8-in. high, and weighs in at 1 1/2 lbs. complete with batteries. On its right side toward the front is a release catch. Push it forward in the direction of the delta and out pops the battery compartment from the right-hand side. It's keyed for polarity and accepts 6 AAs, either alkalines or nicads, the former providing motorized film advance for approximately 50 rolls of 120 film. To mount it on the RZ just turn the camera over, open the sliding cover for the winder-coupling gear, orient the winder on the RZ's bottom until it lies flat, and turn the D-shaped handle on the winder's bottom clockwise. This screws it firmly in place via the tripod socket.

For a unit of such reasonable size and weight, the RZ67 Winder works surprisingly well and does practically everything an action-minded photographer requires, with the sole exception of shooting really rapid sequences. With the film mag loaded but not advanced to "1" you turn the motor on with a little switch on its left-hand side, press a button on its back marked "Start" and the film automatically moves to frame number 1, as does the frame counter, and stops. Each time you press the shutter release, the film will advance to the next frame (or, when set on multi-exposure, cock the shutter for the next exposure without advancing the film) in about 1 sec. to the accompaniment of a moderately loud whirl. Hold your finger on the

shutter release while pressing it in and you can shoot sequences at the rate of approximately 2 frames every 3 sec. In addition to performing these useful feats, the winder does not seem to affect the camera's balance adversely, irrespective of the lens or finder fitted. When you reach the end of the roll the winder winds the paper trailer onto the take-up spool and just keeps winding and whirling away until you turn the motor off. Inelegant perhaps but it keeps the winder's construction simple and reliable while providing an "un-ignorable" signal to switch off and conserve battery power.

Turning from the bottom to the top, one of the first production PD Prism Finders, which converts the RZ67 into a cordless, match-diode metering camera that is, in most respects, very pleasant and convenient. The PD finder mounts atop the RZ in the same way as any finder (after you remove the plastic protective plate used to cover the top set of gold contacts when non-meter finders are used) and transforms it into a convenient eye-level camera. The PD's controls are all clustered on its right-hand side. There's a sliding switch marked "A" and "S" for full-area averaging and spot metering (metering area for the latter corresponds pretty closely to the central focusing spot in the finder with the normal lens in place), and a white push-button which activates the meter. Providing the film speed has been correctly set on the film magazine, metering couldn't be simpler—just turn the shutter-speed dial, the aperture ring or both until the green LED in the center of the vertical array along the right side of the finder lights up. Atop the exposure-readout LEDs there's a red "A" or "S" which lights to tell you whether the meter prism is set for averaging or spot metering. Below that is a 5-LED array with a plus at the top, a minus at the bottom, downward-pointing and upward-pointing orange deltas toward the middle, and a round, green LED dead center. Since the shutter speeds are not stepless, you won't always be able to get a continuous green signal by turning the shutter-speed dial—fine adjustments must be made with the aperture ring. It's quite easy to do this, and the lack of half-stop detents on the aperture ring actually facilitates metering with the PD prism. The exposure difference represented by adjacent LEDs is just under half a stop—a fine enough discrimination for precise metering, but not so fine that the LED readouts suffer from "flickeritis," particularly in the averaging mode.

Generally we were very pleased with the accuracy and convenience of the RZ's PD Prism save for one annoying oversight—there's no way to lock the meter on for continuous field shooting. Each time you press the meter-on button, the meter stays on for only 15 sec. and you often have to push it in for each shot. Although the button itself is conveniently placed, this becomes a pain in the finger. We fully understand Mamiya's concern with battery life on this professional camera, even though they've thoughtfully provided a mechanical flash sync speed of 1/400 sec. which will operate sans battery power. However we hope they'll either lengthen the meter-on time to 45 sec. or so or provide some sort of lock-on switch.

As you can see by perusing the extraordinarily good performance figures for the RZ67 and its lenses, this is one camera that produces the kind of on-film results that justify its high-tech specifications.



## 2 1/4 Single Lens Reflex

### PERFORMANCE

| Our Standard                                                                | Tested    |
|-----------------------------------------------------------------------------|-----------|
| Focal length: $\pm 5\%$<br>(171.00-189.00)                                  | 180.18mm  |
| Aperture: $\pm 5\%$<br>(f/4.28-f/4.73)                                      | f/4.66    |
| Distortion: ( $\pm 3.5\%$ )                                                 | <1%       |
| Light falloff: at f/5.6,<br>+1 stop from theoretical limit<br>(0-1.5 stops) | 0.8 stops |

### RESOLUTION

| Mamiya 180mm f/4.5<br>at 1:21 Magnification |                      |                      |           |    |
|---------------------------------------------|----------------------|----------------------|-----------|----|
| f/no.                                       | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 4.5                                         | Excellent            | 46                   | Excellent | 29 |
| 5.6                                         | Excellent            | 46                   | Excellent | 33 |
| 8                                           | Excellent            | 52                   | Excellent | 33 |
| 11                                          | Excellent            | 52                   | Excellent | 36 |
| 16                                          | Excellent            | 52                   | Excellent | 36 |
| 22                                          | Excellent            | 46                   | Excellent | 33 |
| 32                                          | Excellent            | 41                   | Excellent | 29 |
| 45                                          | Excellent            | 29                   | Excellent | 23 |

### CONTRAST

| Mamiya 180mm f/4.5<br>at 30 lines/mm |            |            |        |    |
|--------------------------------------|------------|------------|--------|----|
| f/no.                                | Center (%) | Corner (%) |        |    |
| 4.5                                  | High       | 42         | V. Low | 6  |
| 5.6                                  | High       | 45         | V. Low | 8  |
| 8                                    | High       | 46         | Low    | 16 |
| 11                                   | High       | 48         | Medium | 23 |
| 16                                   | High       | 41         | High   | 28 |
| 22                                   | Medium     | 34         | High   | 34 |
| 32                                   | High       | 44         | High   | 42 |
| 45                                   | High       | 44         | High   | 50 |

### PERFORMANCE

| Our Standard                                                                | Tested    |
|-----------------------------------------------------------------------------|-----------|
| Focal length: $\pm 5\%$<br>(104.50-115.50)                                  | 111.07mm  |
| Aperture: $\pm 5\%$<br>(f/2.66-f/2.94)                                      | f/2.89    |
| Distortion: ( $\pm 2.0\%$ )                                                 | <1%       |
| Light falloff: at f/5.6,<br>+1 stop from theoretical limit<br>(0-2.1 stops) | 0.8 stops |

### RESOLUTION

| Mamiya 110mm f/2.8<br>at 1:20 Magnification |                      |                      |           |    |
|---------------------------------------------|----------------------|----------------------|-----------|----|
| f/no.                                       | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 2.8                                         | Excellent            | 40                   | Excellent | 25 |
| 4                                           | Excellent            | 50                   | Excellent | 25 |
| 5.6                                         | Excellent            | 57                   | Excellent | 28 |
| 8                                           | Excellent            | 63                   | Excellent | 36 |
| 11                                          | Excellent            | 63                   | Excellent | 45 |
| 16                                          | Excellent            | 57                   | Excellent | 45 |
| 22                                          | Excellent            | 45                   | Excellent | 36 |
| 32                                          | Excellent            | 36                   | Excellent | 32 |

### CONTRAST

| Mamiya 110mm f/2.8<br>at 30 lines/mm |            |            |      |    |
|--------------------------------------|------------|------------|------|----|
| f/no.                                | Center (%) | Corner (%) |      |    |
| 2.8                                  | High       | 64         | High | 42 |
| 4                                    | High       | 67         | High | 56 |
| 5.6                                  | High       | 74         | High | 60 |
| 8                                    | High       | 74         | High | 62 |
| 11                                   | High       | 72         | High | 57 |
| 16                                   | High       | 57         | High | 40 |
| 22                                   | High       | 44         | High | 36 |
| 32                                   | High       | 40         | High | 35 |

### PERFORMANCE

| Our Standard                                                                | Tested       |
|-----------------------------------------------------------------------------|--------------|
| Focal length: $\pm 5\%$<br>(61.75-68.25)                                    | 66.52mm      |
| Aperture: $\pm 5\%$<br>(f/3.80-f/4.20)                                      | f/4.17       |
| Distortion: ( $\pm 3.0\%$ )                                                 | <1% (barrel) |
| Light falloff: at f/5.6,<br>+1 stop from theoretical limit<br>(0-3.4 stops) | 0.9 stops    |

### RESOLUTION

| Mamiya 65mm f/4<br>at 1:20 Magnification |                      |                      |           |    |
|------------------------------------------|----------------------|----------------------|-----------|----|
| f/no.                                    | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 4                                        | Excellent            | 44                   | Excellent | 20 |
| 5.6                                      | Excellent            | 44                   | Excellent | 22 |
| 8                                        | Excellent            | 62                   | Excellent | 28 |
| 11                                       | Excellent            | 62                   | Excellent | 31 |
| 16                                       | Excellent            | 56                   | Excellent | 31 |
| 22                                       | Excellent            | 44                   | Excellent | 31 |
| 32                                       | Excellent            | 35                   | Excellent | 25 |

### CONTRAST

| Mamiya 65mm f/4<br>at 30 lines/mm |            |            |      |    |
|-----------------------------------|------------|------------|------|----|
| f/no.                             | Center (%) | Corner (%) |      |    |
| 4                                 | High       | 57         | High | 40 |
| 5.6                               | High       | 58         | High | 40 |
| 8                                 | High       | 60         | High | 42 |
| 11                                | High       | 60         | High | 46 |
| 16                                | High       | 56         | High | 44 |
| 22                                | High       | 52         | High | 40 |
| 32                                | High       | 45         | High | 34 |

Basically what Mamiya has done is to take one very fine medium-format camera design concept and refine it into something truly magnificent while retaining all the appealing elements of its original character. It is, perhaps, the most successful update of an existing camera design we have run across in the past two decades. We congratulate the engineers responsible for it and commend it almost without reservation.

**Field test slides:** 65mm f/4. Wide open, results were slightly soft in terms of sharpness, but improved markedly on stopping down. Contrast and "snap" were above average at all apertures. Flare was very well controlled throughout, even when shooting directly into the sun.

110mm f/2.8. Slides shot at maximum aperture were fairly sharp, but center and edge sharpness were noticeably better at f/4 and smaller apertures. Overall results were crisp and snappy, exhibiting even illumination across the picture field. Flare was extremely well controlled throughout.

180mm f/4.5. Slides shot at all apertures exhibited very good detail, with sharp, crisp results at all apertures, center and edge. We judged flare control to be superior.

**Optical bench analysis:** (for optical experts only): 65mm f/4. On axis, we observed very slight overcorrected spherical aberration at f/4, but results at f/5.6 were judged to be excellent. Off axis, we noted very slight lateral color (red-green=.020mm), and very slight astigmatism wide open, but the image pattern was improved to very good at f/8 and smaller apertures.

110mm f/2.8. On axis at maximum aperture we detected slight zonal spherical aberration with slight red fringing, but the pattern improved to excellent at f/5.6 and smaller f/stops. Off axis we observed weak skew-ray

flare, and very slight coma wide open, but the image pattern was judged to be excellent by f/5.6. No lateral color or astigmatism was visible at any aperture—a superior performance.

180mm f/4.5. On axis, wide open, we noted slight spherical aberration, but no other defects. Image quality by f/8 was excellent. Off axis, slight color variation of coma was visible at maximum aperture, but no astigmatism or flare. Slight lateral color (red-green=.024mm) was seen at f/4.5, but the image pattern was judged to be very good at f/8 and smaller apertures. (June 1983)

## Pentax 645: 2 1/4 × 1 5/8 Designed to Work Like 35mm SLR

**MANUFACTURER'S SPECIFICATIONS:** PENTAX 645 2 1/4 × 1 5/8 IN. (6 × 4.5 cm) eye-level reflex camera. Body No. 1002312. LENS: 75mm f/2.8 SMC Pentax-A in Pentax 645A bayonet mount, No. 4009244. SHUTTER: Vertical travel electronically-controlled cloth focal-plane with speeds from 15 to 1/1000 sec. plus B, X sync at 1/60 sec., 1/60 sec. mechanical speed. EXPOSURE SYSTEMS: Program, shutter-speed preferred, aperture preferred, metered manual, TTL and program flash. GPD cells in finder read center-weighted area of focusing screen; EV3-19 (at ISO/ASA 100); ISO/ASA 6-6400; exposure compensation  $\pm 3$  stops in full stop increments, exposure on-off switch. FLASH: Dedicated hot shoe TTL with GPD metering cell in mirror chamber reading directly from film surface during exposure, sync speed set for all modes except manual, auxiliary PC terminal. VIEWFINDER: Non-interchangeable eye-level prism with horizontal split-image rangefinder, microprism collar, full area focusing; variable diopter adjustment -5 to +2; interchangeable focusing screens; LEDs indicate shutter speeds, apertures, exposure-compensation warning, out-of-meter coupling and exposure range, flash ready and flash confirmation, B, lens shutter operation. OTHER FEATURES: Batteries in handle power shutter, exposure indicators, built-in motor wind; external LCD window indicates aperture-priority f/stop, shutter-priority speed, program mode, aperture priority with lens set manually, metered shutter speed in manual, 1/60, B, lens shutter in use, exposure-compensation factor, ISO/ASA film speed, frame number count, flash ready signal; interchangeable 120 (15 exposure), 220 (30 exposure) and 70mm (about 90 exposures) film insert backs, auto wind to first exposure, single and continuous exposure release, provision for multiple exposures, manual mechanical 1/60 sec. shutter release and advance, remote release, horizontal- and vertical-hold tripod sockets, LCD illuminator, LED on-off switch, film box end holder, depth-of-field preview lever, built-in memory circuit, auto power turn off, electro-magnetic shutter release, removable grip. BATTERIES: Six 1.5 volt AA cells power camera, lithium battery (min. life 5 years) provides memory data circuit, is replaceable at service center. PRICE: \$1470.00.



## What's New At A Glance: Pentax 645

LCD operating panel

Removable motor drive  
battery power handle with  
electromagnetic shutter release

Power on-off switch

Exposure change  
selecting buttons

Variable diopter telescopic  
viewfinder with removable,  
interchangeable eyecup

Exposure/mode/film speed/  
exposure factor/LCD  
and LED light buttons

Non-interchangeable prism  
finder with LED exposure  
information display

Dedicated TTL flash hot shoe

New lens series in special  
Pentax-A 645 bayonet  
mount using electric contacts

Depth of field  
preview lever

Lens release button

Asahi Pentax has probably had more experience in designing SLRs in different formats than any other manufacturer. When they introduced first their 6 × 7 SLR and then the tiny 110, both were very much in the shape of a standard Pentax 35mm SLR. With the 645 however, Pentax breaks with tradition, not only their own but even established 4.5 × 6 tradition.

The Pentax 645 does not look like a 35mm camera at all. It has the basic cube configuration common to most 2 1/4 SLRs be they of square (2 1/4 × 2 1/4 in.), or oblong (2 1/4 × 1 5/8 in., 2 1/4 × 2 3/4 in.) picture dimensions. Why not a standard 35mm SLR shape? Because the 2 1/4 × 1 5/8 in. format would have necessitated a 35mm-style SLR that took a vertical picture when hand-held most comfortably (since film must travel horizontally and has a vertical height of 2 1/4 in.). The camera would have had to have been turned on its side in order to make horizontals (which account for the greatest percentage of pictures shot).

Once deciding on the cube, a more logical shape, Pentax went about solving two more important problems: 1) how to produce a 6 × 4.5cm. camera different than those made by Mamiya and Bronica and 2) how to make it handle more conveniently at eye level than other cube-shaped cameras past or present. They solved both problems by daring and radical design decisions. They would create a highly compact SLR which had the operational ease and features of a full-featured 35mm automatic SLR. But to do this they would have to make some sacrifices—the most important of which would be to eliminate the possibilities of interchangeable finders and backs. What they achieved undeniably is a 6 × 4.5 SLR which handles far more like a multi-exposure-mode 35mm SLR than any other and indeed in many ways matches the abilities and conveniences of top grade 35mm SLRs. Just how Pentax designers accomplished this and how well the camera works will be covered in this report, as will a description of how you operate such an unusual camera.

Certainly the first logical question facing any 35mm camera user on confronting the Pentax 645 would be: "What's the best way of holding this machine?" Even though the shape is a cube, the answer oddly enough is: "Just like a 35mm camera." You support the camera in the palm of your left hand with

your fingers far enough forward so you can grasp the lens for focusing and aperture changing. With the right hand you grasp—not the right side of the camera—but that part of the camera that sticks out to the right, namely the grip which also holds the 6 AA cells which power it. While the forward cant of the grip appears odd, it provides an excellent balance—so even when you are holding the camera by the grip alone, the camera is not front heavy but maintains a nice level orientation (unless, of course, you attach a tele lens). The rubberized, studded surface provides a fine, secure grasp with your forefinger resting naturally atop the large, prominent chrome shutter release button (which is threaded for a cable release). Now you lift the camera to eye level. Good grief, it does seem to be a 35mm SLR! Only it's additional size and weight betray its larger format.

To load the 645, you lift up the film back key and twist it 90° counterclockwise in the direction of the arrow until two red dots match. The back and film holder can now be removed. (You can't release the shutter without film in the camera unless you remove the back, and complete operation of the camera isn't possible unless you remove the back, and complete operation of the camera isn't possible unless the camera is loaded).

The film holder loads with roll film in much the same manner as other roll film SLRs and is no more difficult or easy (70mm backs were not available for us to try at test time).

You wind on the paper backing leader manually until a heavy arrow line matches red markings on the supply film spool holder. You then reinsert the back into the camera. By pressing the sturdy, well placed on/off rocker switch "on", the camera's motor comes to life, winding the film to the first exposure which is shown in the "ex" window on the top LCD panel. During winding, a red operating diode lights just atop the LCD panel. To set the ISO/ASA film speed, you press the ISO button on the left top side of the camera while pressing the selecting buttons on the right. Film speeds will cycle in the LCD mode window. When the right one appears, remove pressure from the buttons and let go of the ISO button.

What auto exposure mode do you wish to use? Once you have set the lens's aperture scale to the "A" position, you can press

down the left hand "mode" button and, with the right hand selecting buttons, choose program, aperture-preferred or shutter-speed preferred auto exposure (the setting appears in the mode window of the LCD panel as "Auto P", Auto with f/stop and Auto with shutter speed respectively). The LCD panel can be lit for viewing in poor light by pressing a left hand button with a circle inscribed on it. This light goes off automatically in approximately 12 sec.

While no shutter speeds or apertures appear on the LCD panel in program and only one or the other in the aperture or shutter preferred modes, full information is clearly visible within the viewfinder in bright red LED numbers against a black background inset in the lower right hand section of the viewing screen. The LEDs are turned on by either slightly pressing the shutter release or pushing the LED control button. Sometimes one does the trick, sometimes the other. The LEDs go out automatically about 30 sec. after lighting. The designers have very cleverly furnished you with all the necessary operational information topside and the critical specifics inside. Possible settings are in half stops and speeds of 15", 8", 4", 2", 1", 2, 4, 8, 15, 30, 60 etc. to 1/1000. The actual settings executed—shutter speed or aperture or both in program—are infinitely variable.

For manual operation, you press the auto exposure release button on the lens and turn the ring to whatever aperture you wish. Using the selecting buttons, you can set your shutter speed. The LCD panel will indicate an "M" and the shutter speed set. In the viewfinder you will find LEDs displaying your shutter speed plus signs showing o1, o2, o3 or -1, -2, -3 indicating how far away you are from correct exposure. When you and the camera's metering system agree, an "OK" appears. If your setting is more than 3 stops off, the o3 or -3 indicators blink in warning. Whenever any setting in any mode is outside of the exposure range or meter coupling range, one or the other or both numeral indicators within the viewfinder and atop the camera blink. The exact amount of auto exposure compensation you set appears on the LCD in full EV variations only. (Unfortunately, you cannot vary this adjustment in smaller amounts). The LED display in the finder indicates a plus or minus.

When you hold the camera to eye-level,



## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                                        | As Tested                                           |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                                     |                                                     |
| Apparent viewing distance                | Between infinity and 20 in. (0.5m)                                                                                  | 39 in. (1.0m)                                       |
| Apparent distance of shutter-speed scale | Between 79 in. (2.0m) and 26 in. (0.66m)                                                                            | 56 in. (1.4m)                                       |
| Apparent distance of aperture scale      | Same as above                                                                                                       | 56 in. (1.4m)                                       |
| View area compared to film area          | Vertically and horizontally more than 90%, less than 100%                                                           | Vertical: 92%<br>Horizontal: 93%                    |
| Parallax error compared to film          | Vertical: 1.6mm<br>Horizontal: 1.96mm                                                                               | Vertical: 0.45mm (up)<br>Horizontal: 0.25mm (right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                               | No Discrepancy                                      |
| Image magnification                      | 0.75X ± 1X                                                                                                          | 0.83X                                               |
| <b>PICTURE SIZE:</b>                     | 56±1.4mm<br>× 41.5±1.04mm                                                                                           | 56.2mm × 41.2mm                                     |
| <b>SHUTTER:</b>                          |                                                                                                                     |                                                     |
| Curtain travel evenness                  | ±0.33 stop                                                                                                          | -0.26 stop                                          |
| Insulation from sync                     | More than 7 megohms                                                                                                 | Infinity                                            |
| Sync contact efficiency                  | More than 60%                                                                                                       | 84% (hot shoe)<br>89% (pc)                          |
| Sync delay time                          | × within full opening                                                                                               | Okay                                                |
| Shutter curtain bounce                   | Not allowed                                                                                                         | None                                                |
| <b>CAMERA SIZE:</b>                      | Body: 5½ in. wide × 4¾ in. high × 4¾ in. deep (145 × 107 × 117mm)<br>Lens: 1¾ in. long, 2⅜ in. diameter (46 × 73mm) |                                                     |
| <b>WEIGHT:</b>                           | Body: 3 lb. 4⅞ oz. (1487g) with grip and batteries<br>Lens: 8½ oz. (241g)                                           |                                                     |

you will see a focusing screen of a size and brightness remarkably like that in a top quality 35mm SLR, thanks to the unusual telescopic viewfinder atop the camera. The screen may at first be blurry, a situation which can usually be cleared up easily by turning the rubberized ring around the eyepiece, thus adjusting the diopter correction exactly to your eye. While the diopter range is wide (see specifications) Pentax makes additional correction eyepieces for people who need corrections beyond this large range. The eyepiece ring is marked with indented indications so you can reset your own diopter values, but we think these should be marked in white so you can see them more easily. A locking ring would also be useful to prevent accidental movement. The rubberized external eyepiece ring (which prevents eyeglasses from being scratched) can be replaced with a large semicircular rubberized eyepiece (furnished) to give your camera better support against your forehead—a thoughtful touch.

The split-image rangefinder, microprism collar and fine focusing outer area resemble and are used like those in a 35mm SLR. Eyeglass wearers can see the entire viewing and finder information. The split-image rangefinder is easily useable with lenses having apertures of f/5.6 or larger but operable with precise eye placement to about a half stop smaller. Pressure on the shutter-release but-

ton causes swift action with not much more noise than in a 35mm SLR. In 1.6 sec. (according to our tests) the camera has made the exposure when shooting at 1/125 sec. or faster and wound film and shutter for the next exposure. You have your choice of single shots or bursts (when you hold your finger on the release after setting the control to the "C" position). An entire roll of 15 shots can be cycled through the camera in 24 sec. Following the last exposure, film is automatically wound completely onto the takeup spool for removal. According to Pentax, approximately 250 rolls of 120 film can be run through with one set of alkaline energizer batteries. We probably felt somewhat short of that number of test rolls but we did not have to change batteries while the camera was in our hands.

The right side of the camera has but one control, the large, easy to reach and operate depth-of-field preview lever. The back of the camera contains the opening latch and adjacent film reminder slot. At top left, you'll find the SC single and continuous release knurled wheel. The left side of the camera contains many controls. There's a non-dedicated PC flash contact, a multiple exposure control ring, large vertical position tripod socket and bushing, red wind-indicator window and manual film wind guide socket. This socket can be used to operate the 645 manually if batteries fail. You unthread the man-

ual film wind knob from the bottom of the camera and thread it into the socket. You can then advance film by turning the knob (which is appropriately knurled) clockwise until the red wind signal appears indicating film has been positioned and the shutter is wound. A slight turn of the knob counter-clockwise will release the shutter manually at 1/60 sec. You can continue operating in this manner until the end of the roll. However, the frame counter will not be operating.

On the bottom of the 645, along with the tripod socket and stored manual wind knob, is the power and release terminal which normally connects to the battery container hand grip. However, by removing the grip and connecting a remote control cord between grip and terminal you can operate the camera from a distance. While the grip is removed (or the batteries changed), the lithium memory battery retains exposure info, frame number and ISO/ASA film speed setting. The grip bottom itself incorporates an external power source terminal as well as the battery holder release and grip lock attaching screw. Oddly enough, this very comprehensive camera lacks a self-timer. While it may be argued that this is a professionally oriented camera and a self-timer strictly an amateur device, the ST certainly comes in handy as an emergency cable release or remote control substitute—even for pros.

Atop the camera on the right hand side near the back are the up-down exposure change buttons and the LCD control panel, while the main on-off switch and shutter release occupy the grip top. The controls are easily reached at eye level with your right forefinger. The center of the prism rear holds the dedicated TTL flash shoe (more about that later) while the left side of the top panel contains the various control buttons which, while not too easy to sort out at eye-level, are not likely to be needed for eye level operation anyhow.

On the right and left rear sides of the 645 are strap lugs to which you fasten the excellent neckstrap by means of a coin edge or similar item (which is also needed to remove same). The fasteners hold the camera quite securely. The adjustable strap has a 1½ in.-wide central section with non-slip backing. In keeping with the latest camera manufacturer furnished strap fashion, the top of the black strap is emblazoned with the word "Pentax" in large red capital letters.

Coming now to the front of the 645, we have a large chrome trimmed black button at the bottom-left-hand corner which, not surprisingly, is the lens release button. To remove a lens, you press said button while turning the lens approximately 60° counter-clockwise. Each lens has a large orangish button on its barrel which you can align with the release button even by feel when attaching the lens.

The mirror chamber from the front looks much like that in a 35mm SLR with seven electric contacts to relay aperture information to the camera from the lens (and vice-versa), aperture stop-down lever and aperture stop control ring and lug. On the bottom of the mirror chamber, facing towards the film plane is a single GPD cell for off-film-surface flash measurement. Atop the mirror is the focusing screen release latch which when pressed to the left causes the screen frame to drop down allowing the screen to be removed and replaced with four other screens: microprism and full focusing only;



plain, full area focusing screen only and horizontally and vertically lined full focusing screen.

While a complete lens system is promised, the initial group include those which we are testing this month (following the camera report) plus a 300mm f/4 ED. Additionally, an adapter allows Pentax 6 x 7 system lenses to be mounted for aperture priority, manual, metered manual and TTL auto flash modes only. Tele converters, auto and variable helicoid extension tubes, closeup lenses plus an autobellows have been announced. Naturally we asked about macro lenses and were told that the manufacturing these would be given priority in the future.

Among other accessories are: macro stand, reverse lens adapters, quick tripod shoe, right angle finder, remote battery pack, power cords, critical magnifier, and an adapter to allow Pentax 645 lenses to be used manually on Pentax bayonet mount 35mm cameras.

The 645's flash systems are comprehensive. While you can use the camera for manual flash from both the hot shoe and body terminals or for direct auto flash from the hot shoe, the most useful flash method for most applications will be through the lens auto flash measurement and setting using any one of three presently available Pentax TTL-capable flash units.

In program exposure, the TTL flash aperture is selected depending on the ISO/ASA film speed set on the camera. With ASA 25 film, f/2.8 is set, but this aperture blinks in the finder, warning you that even this aperture isn't large enough. You can't use program exposure with ASA/ISO films. With 50 speed film f/2.8 is set and is OK in program. ASA 100 film provides f/4, 400 film yields f/8, 1000 film offers f/11 and 1600 uses f/16. Shutter speed is automatically set to 1/60 sec. when the flash unit recycles. Naturally the auto flash range depends on the power of the flash unit used. If the camera is in shutter-priority auto-exposure mode, the same apertures will also be automatically selected and the shutter speed automatically set to 1/60 sec. To retain full control over your aperture in TTL flash mode, you need aperture-priority auto-exposure control with the lens aperture ring turned to the actual aperture you wish to use. The finder will show the automatically set 1/60 sec. flash sync speed when you're ready to shoot but no aperture identification, just an "F---" indication.

If you wish to use TTL auto flash at slower shutter speeds for combinations of flash plus existing light, you can do it by setting apertures manually and shutter speeds below 1/60 sec. At higher speeds, the shutter will again be automatically set to 1/60 sec. In other words, you are in effect using aperture-priority auto exposure with TTL flash at slow speeds.

TTL auto flash is also available at f/8 and 1/60 sec. manual settings. In all auto flash settings, a lightning marker atop the shutter speed indication in the viewfinder lights when the flash has recycled and is ready to fire. While recycling, the camera reverts to whatever existing exposure mode was originally set. The lightning mark blinks following exposure if illumination was sufficient.

As might be expected, becoming accustomed to the various exposure modes, push button controls, LCD and LED information readouts was the most difficult task our field testers had to face in using the camera. It

was akin to learning how to set and use a new multi-purpose digital electronic watch. We would advise new owners to set aside a few hours prior to actual use for just such acclimatization. Once operations are learned however, (and reviewed from time to time if the camera isn't regularly used) the camera can be controlled quite efficiently.

Almost everyone field testing the Pentax 645 found it to be an exhilarating experience and was surprised at the fast, 35mm-like camera operation and convenience of handling and taking pictures. Only those who wished the camera to be more of a studio unit (it has neither waist level reflex viewfinder, nor film backs interchangeable in mid roll) were disappointed.

In our experience however, few photographers really change backs in mid roll but instead use the feature for reloading swiftly at roll end by substituting a freshly loaded film holder back for a used one. For this reason additional backs with film holders are available. Each comes in a light-tight box. These holders can be preloaded and substituted for the used film holders at roll end with equal speed to cameras with fully interchangeable backs.

For an active photographer who shoots on the run and who isn't satisfied with the image quality of the 35mm format, Pentax has now supplied an ideal medium-format substitute. (February 1985)

## PENTAX 645 LENS TESTS

**Specifications:** 45mm f/2.8 SMC Pentax-A 645 no. 4023279 in Pentax 645A bayonet lens mount, accepts 67mm accessories f/2.8-f/22 with half-stop detents to f/16, full stop to f/22 plus locked A setting, min. foc. dist. 1 1/2 ft. (0.5m); 2 9/16 in. long, 2 15/16 in. diam. (66.5 x 74mm), 14 oz. (400g). \$473.00.

**Specifications:** 55mm f/2.8 SMC Pentax-A645 no. 4014460 in Pentax 645A bayonet lens mount, accepts 58mm accessories, f/2.8-f/22 with half stop detents from f/4-f/16, full stop from f/16-f/22 plus locked A setting, min. foc. dist. 1 1/2 ft. (0.5m); 2 3/8 in. long, 2 5/16 in. diam. (60.5 x 74mm), 14 1/2 oz. (410g) \$420.00.

**Specifications:** 75mm f/2.8 SMC Pentax-A645 no. 4009244 in Pentax 645A bayonet lens mount, accepts 58mm accessories, f/2.8-f/22 with half-stop detents to f/16, full stop to f/22 plus locked A setting, min. foc. dist. 2 1/8 ft. (0.6m); 1 1/2 in. long, 2 15/16 in. diam. (37.5 x 74mm), 8 1/2 oz. (240g) \$270.00.

**Specifications:** 75mm f/2.8 SMC Pentax 645 LS no. 19002 in Pentax 645A bayonet mount, accepts 58mm accessories, has built-in, manually cocked leaf shutter with speeds from 1/60-1/500 sec. for high shutter speed, non-auto, non-TTL flash using lens barrel PC terminal. Camera shutter automatically sets to 1/8 sec. Lens can also be used as standard with leaf shutter inoperative, but in aperture-preferred auto exposure, TTL flash and manual modes only. Apertures f/2.8-f/16 with half stop detents to f/16, third stop detents be-

## 2 1/4 Single Lens Reflex PERFORMANCE

| Our Standard                                                                      | as Tested         |
|-----------------------------------------------------------------------------------|-------------------|
| <b>Focal length:</b> ±5%<br>(42.75-47.25mm)                                       | 44.53mm           |
| <b>Aperture:</b> ±5%<br>(f/2.66-2.94)                                             | f/2.84            |
| <b>Distortion:</b><br>(±1.5%)                                                     | under 1% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.6 stops) | 0.8 stops         |

### RESOLUTION

| PENTAX-A 645 45mm f/2.8<br>at 1: 20 |                  |    |                  |    |
|-------------------------------------|------------------|----|------------------|----|
| f/                                  | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 2.8                                 | Good             | 40 | Excellent        | 32 |
| 4                                   | Good             | 40 | Excellent        | 36 |
| 5.6                                 | V. Good          | 50 | Excellent        | 45 |
| 8                                   | Excellent        | 57 | Excellent        | 45 |
| 11                                  | Excellent        | 63 | Excellent        | 50 |
| 16                                  | Excellent        | 63 | Excellent        | 50 |
| 22                                  | Excellent        | 57 | Excellent        | 45 |

### CONTRAST

| PENTAX-A 645 45mm f/2.8<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------------|---------------|----|---------------|----|
| f/                                        | Center<br>(%) |    | Corner<br>(%) |    |
| 2.8                                       | High          | 58 | High          | 47 |
| 4                                         | High          | 65 | High          | 50 |
| 5.6                                       | High          | 69 | High          | 53 |
| 8                                         | High          | 71 | High          | 57 |
| 11                                        | High          | 65 | High          | 47 |
| 16                                        | High          | 61 | High          | 44 |
| 22                                        | High          | 57 | High          | 41 |

### PERFORMANCE

| Our Standard                                                                      | As Tested         |
|-----------------------------------------------------------------------------------|-------------------|
| <b>Focal length:</b> ±5%<br>(52.25-57.75mm)                                       | 56.12mm           |
| <b>Aperture:</b> ±5%<br>(f/2.66-2.94)                                             | f/2.71            |
| <b>Distortion:</b><br>(±1.5%)                                                     | under 1% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.4 stops) | 0.4 stops         |

### RESOLUTION

| PENTAX-A 645 55mm f/2.8<br>at 1:20 |                  |    |                  |    |
|------------------------------------|------------------|----|------------------|----|
| f/                                 | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 2.8                                | V. Good          | 45 | Excellent        | 36 |
| 4                                  | Excellent        | 50 | Excellent        | 40 |
| 5.6                                | Excellent        | 57 | Excellent        | 45 |
| 8                                  | Excellent        | 63 | Excellent        | 50 |
| 11                                 | Excellent        | 57 | Excellent        | 50 |
| 16                                 | Excellent        | 57 | Excellent        | 45 |
| 22                                 | Excellent        | 50 | Excellent        | 40 |

### CONTRAST

| PENTAX-A 645 55mm f/2.8<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------------|---------------|----|---------------|----|
| f/                                        | Center<br>(%) |    | Corner<br>(%) |    |
| 2.8                                       | High          | 64 | High          | 49 |
| 4                                         | High          | 66 | High          | 50 |
| 5.6                                       | High          | 69 | High          | 54 |
| 8                                         | High          | 71 | High          | 58 |
| 11                                        | High          | 63 | High          | 49 |
| 16                                        | High          | 60 | High          | 48 |
| 22                                        | High          | 52 | High          | 40 |



## 2 1/4 Single Lens Reflex

### PERFORMANCE

| Our Standard                                                                       | as Tested |
|------------------------------------------------------------------------------------|-----------|
| <b>Focal length:</b> ±5%<br>(71.25 - 78.75mm)                                      | 77.47mm   |
| <b>Aperture:</b> ±5%<br>(f/2.66-2.94)                                              | f/2.93    |
| <b>Distortion:</b><br>(±2%)                                                        | under 1%  |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>(0-1.7 stops) | 1.5 stops |

### RESOLUTION

| PENTAX-A 645 75mm f/2.8<br>at 1: 20 |                  |    |                  |    |
|-------------------------------------|------------------|----|------------------|----|
| f/                                  | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 2.8                                 | Good             | 41 | V. Good          | 32 |
| 4                                   | Good             | 41 | Good             | 32 |
| 5.6                                 | Good             | 45 | V. Good          | 36 |
| 8                                   | V. Good          | 51 | V. Good          | 36 |
| 11                                  | Excellent        | 57 | Excellent        | 45 |
| 16                                  | Excellent        | 57 | Excellent        | 45 |
| 22                                  | Excellent        | 51 | V. Good          | 41 |

### CONTRAST

| PENTAX-A 645 75mm f/2.8<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------------|---------------|----|---------------|----|
| f/                                        | Center<br>(%) |    | Corner<br>(%) |    |
| 2.8                                       | High          | 48 | High          | 43 |
| 4                                         | High          | 66 | High          | 47 |
| 5.6                                       | High          | 71 | High          | 54 |
| 8                                         | High          | 77 | High          | 60 |
| 11                                        | High          | 72 | High          | 58 |
| 16                                        | High          | 59 | High          | 53 |
| 22                                        | High          | 47 | High          | 42 |

### PERFORMANCE

| Our Standard                                                                       | as Tested         |
|------------------------------------------------------------------------------------|-------------------|
| <b>Focal length:</b> ±5%<br>(142.50-157.50mm)                                      | 151.44mm          |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)                                              | f/3.55            |
| <b>Distortion:</b><br>(±2.5%)                                                      | under 1%(pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>(0-1.1 stops) | 0.5 stops         |

### RESOLUTION

| PENTAX-A 645 150mm f/3.5<br>at 1: 20 |                  |    |                  |    |
|--------------------------------------|------------------|----|------------------|----|
| f/                                   | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                  | Excellent        | 50 | Excellent        | 45 |
| 5.6                                  | Excellent        | 57 | Excellent        | 50 |
| 8                                    | Excellent        | 57 | Excellent        | 50 |
| 11                                   | Excellent        | 63 | Excellent        | 50 |
| 16                                   | Excellent        | 57 | Excellent        | 45 |
| 22                                   | Excellent        | 50 | Excellent        | 45 |
| 32                                   | Excellent        | 50 | Excellent        | 40 |

### CONTRAST

| PENTAX-A 645 150mm f/3.5<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------------|---------------|----|---------------|----|
| f/                                         | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                        | High          | 47 | High          | 44 |
| 5.6                                        | High          | 59 | High          | 48 |
| 8                                          | High          | 76 | High          | 49 |
| 11                                         | High          | 73 | High          | 52 |
| 16                                         | High          | 59 | High          | 40 |
| 22                                         | High          | 55 | Medium        | 34 |
| 32                                         | High          | 44 | Medium        | 29 |

### PERFORMANCE

| Our Standard                                                                                                     | as Tested                  |
|------------------------------------------------------------------------------------------------------------------|----------------------------|
| <b>Focal length:</b> ±5%<br>( 76.00- 84.00mm)<br>(152.00-168.00mm)                                               | 83.27mm<br>156.17mm        |
| <b>Aperture:</b> ±5%<br>(f/4.28-4.73)<br>at 160mm (f/4.28-4.73)                                                  | f/4.51<br>f/4.60           |
| <b>Distortion:</b><br>80mm: (±2%)<br>160mm: (±2.5%)                                                              | under 1%<br>under 1% (pin) |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>80mm: (0-1.2 stops)<br>160mm: (0-1.1 stops) | 0.3 stops<br>0.8 stops     |

### RESOLUTION

| PENTAX-A 645 80-160mm f/4.5<br>at 80mm<br>at 1: 20 |                  |    |                  |    |
|----------------------------------------------------|------------------|----|------------------|----|
| f/                                                 | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4.5                                                | V. Good          | 45 | Excellent        | 40 |
| 5.6                                                | V. Good          | 50 | Excellent        | 40 |
| 8                                                  | V. Good          | 50 | Excellent        | 45 |
| 11                                                 | Excellent        | 57 | Excellent        | 45 |
| 16                                                 | Excellent        | 50 | Excellent        | 45 |
| 22                                                 | Excellent        | 50 | Excellent        | 45 |
| 32                                                 | V. Good          | 45 | Excellent        | 40 |

### CONTRAST

| PENTAX-A 645 80-160mm f/4.5<br>at 80mm at 30 lines/mm |               |    |               |    |
|-------------------------------------------------------|---------------|----|---------------|----|
| f/                                                    | Center<br>(%) |    | Corner<br>(%) |    |
| 4.5                                                   | High          | 54 | High          | 40 |
| 5.6                                                   | High          | 55 | High          | 47 |
| 8                                                     | High          | 60 | High          | 49 |
| 11                                                    | High          | 63 | High          | 51 |
| 16                                                    | High          | 55 | High          | 49 |
| 22                                                    | High          | 49 | High          | 38 |
| 32                                                    | Medium        | 34 | Medium        | 32 |

### RESOLUTION

| PENTAX-A 645 80-160mm f/4.5<br>at 120mm at 1: 20 |                  |    |                  |    |
|--------------------------------------------------|------------------|----|------------------|----|
| f/                                               | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4.5                                              | Excellent        | 45 | Excellent        | 40 |
| 5.6                                              | Excellent        | 50 | Excellent        | 45 |
| 8                                                | Excellent        | 50 | Excellent        | 45 |
| 11                                               | Excellent        | 57 | Excellent        | 50 |
| 16                                               | Excellent        | 50 | Excellent        | 45 |
| 22                                               | Excellent        | 50 | Excellent        | 45 |
| 32                                               | Excellent        | 45 | Excellent        | 40 |

### CONTRAST

| PENTAX-A 645 80-160mm f/4.5<br>at 120mm at 30 lines/mm |               |    |               |    |
|--------------------------------------------------------|---------------|----|---------------|----|
| f/                                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 4.5                                                    | High          | 54 | High          | 40 |
| 5.6                                                    | High          | 60 | High          | 45 |
| 8                                                      | High          | 63 | High          | 47 |
| 11                                                     | High          | 66 | High          | 50 |
| 16                                                     | High          | 55 | High          | 44 |
| 22                                                     | High          | 50 | High          | 39 |
| 32                                                     | Medium        | 35 | Medium        | 31 |

tween f/2.8 and f/4 full stop from f/16-f/22 plus locked A setting, min. foc. dist. 2 1/2 ft., (0.75m); 1 15/16 in. long, 3 in. diam. (49.5×76mm), 12 3/4 oz. (365g). \$500.00.

**Specifications:** 150mm f/3.5 SMC Pentax-A645 no. 4013688 in Pentax 645A bayonet lens mount, accepts 58mm

### RESOLUTION

| PENTAX-A 645 80-160mm f/4.5<br>at 160mm at 1:20 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/                                              | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4.5                                             | Excellent        | 45 | Excellent        | 36 |
| 5.6                                             | Excellent        | 50 | Excellent        | 40 |
| 8                                               | Excellent        | 50 | Excellent        | 45 |
| 11                                              | Excellent        | 57 | Excellent        | 45 |
| 16                                              | Excellent        | 50 | Excellent        | 45 |
| 22                                              | Excellent        | 45 | Excellent        | 40 |
| 32                                              | V. Good          | 40 | Excellent        | 36 |

### CONTRAST

| PENTAX-A 645 80-160mm f/4.5<br>at 160mm at 30 lines/mm |               |    |               |    |
|--------------------------------------------------------|---------------|----|---------------|----|
| f/                                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 4.5                                                    | High          | 52 | High          | 43 |
| 5.6                                                    | High          | 60 | High          | 45 |
| 8                                                      | High          | 67 | High          | 49 |
| 11                                                     | High          | 70 | High          | 51 |
| 16                                                     | High          | 56 | High          | 43 |
| 22                                                     | High          | 50 | High          | 40 |
| 32                                                     | Medium        | 35 | Medium        | 29 |

accessories, built-in sliding lens-shroud with rubber lip, f/3.5 to f/32 with half stop detents f/5.6-f/22, full stops from f/4-f/5.6, f/22-f/32 plus locked A setting, min. foc. dist. 4 1/2 ft. (1.4m); 2 13/16 in. long, 2 15/16 in. diam. (71.5×74mm), 15 1/2 oz. (440g). \$525.00

**Specifications:** 80-160mm f/4.5 Zoom SMC Pentax-A645 no. 4021145 in Pentax 645A bayonet lens mount, accepts 77mm accessories, separate zoom and focusing control rings, f/4.5 to f/32 with half-stop detents to f/22, full stop to f/32 plus locked A setting, min. foc. dist. 3 1/2 ft. (1m), 5 1/8 in. long, 3 1/4 in. diam. (131×82.5mm), 35 1/2 oz. (1020g). \$917.00.

**Practical comments:** All SMC Pentax A645 lenses were well finished in shiny black with good sized numerals, both feet and meter markings, clear depth-of-field scales, oversized, easy-to-grip aperture ring knurlings, heavily ribbed rubberized focusing rings, yellow attaching alignment buttons.

**Field test slides:** 45mm f/2.8; Very slight softness overall wide open, improves greatly by f/5.6. Slight loss of sharpness in corner when compared with center, particularly at large apertures. Flare well controlled throughout. Slightly above average performer for a lens of this type.

**55mm f/2.8:** Slightly soft, wide open, overall, greatly improved by f/4. Sharpness holds well center to corners throughout with some softness at f/16 and beyond. Flare well controlled throughout. Slightly above average for a lens of its type.

**75mm f/2.8:** (both optically identical) Very slight softness overall at wider apertures. Sharpness greatly improved by f/5.6 with slight reduction at f/22. Flare well controlled throughout. Average performance for a lens of this class.



150mm f/3.5 Slightly soft overall wide open but greatly improved by f/5.6. Sharpness holds well center to corner. Flare well controlled throughout. Slightly above average performance for a lens of this type.

80-160mm f/4.5 provided extremely consistent exposure throughout. Images crisp, and snappy. At 80mm, slides were slightly soft at wide apertures but by f/8 sharpness improves with corners equal to center. Very slight loss of sharpness at f/32. Flare well controlled. At 120mm, performance was similar but corners improved by f/5.6. At 160mm, performance was again similar with flare well controlled throughout. Performance was above average for a lens of this type.

**Optical bench analysis** (for optical experts only): 45mm F/2.8; on axis, very slight astigmatism could be seen in center. Diffraction limited by f/5.6. Off axis, there was slight coma with mixed slight skew ray flare. Lateral color throughout.

55mm f/2.8 on axis, slight axial color was visible with very slight red flare, gone by f/5.6. Lateral color throughout. Off axis, there was slight coma mixed with slight astigmatism. Lateral color throughout.

75mm f/2.8 (both optically identical) On axis, slight primary under-corrected spherical aberration could be seen, diffraction limited by f/8. Off axis, slight coma mixed with very slight astigmatism, lateral color throughout.

150mm f/3.5 on axis, slight primary under corrected spherical aberration was visible. Diffraction limited by f/8. Off axis, there was slight skew-ray flare mixed with slight astigmatism. Lateral color throughout.

80-160mm f/4.5 At 80mm on axis, primary under corrected spherical aberration was present with very slight red flare, gone by f/8. Diffraction limited by f/8. Off axis, slight skew-ray flare could be seen mixed with slight coma. Lateral color throughout. At 120mm on axis, slight primary under-corrected spherical aberration was present with slight astigmatism gone by f/8. Diffraction limited by f/8. Off axis, slight skew-ray flare mixed with slight astigmatism. Lateral color throughout. At 160mm on axis, slight undercorrected spherical aberration was present with slight axial astigmatism gone by f/8. Diffraction limited by f/8. Off axis, slight skew-ray flare mixed with slight astigmatism. Lateral color throughout. (February 1985)

## ROLLEI 6006 HAS CHANGEABLE BACKS

**MANUFACTURER'S SPECIFICATIONS:** Rolleiflex 6006 2 1/4 x 2 1/4 in. (6x6 cm.) single-lens reflex camera. Body no. 803520184. LENS: Rollei 80mm f/2.8 Planar in Rollei bayonet mount, apertures to

f/22, focusing to 3 ft. (0.9m), accepts Rollei bayonet-mounting accessories. **SHUTTER:** Electronically-controlled inter-lens leaf (in each lens) with speeds of 30- 1/500 sec., plus B, X-sync. **VIEWING:** Interchangeable waist-level finder with built-in sportsfinder, full-area magnifier, with interchangeable focusing screens having central, split-image rangefinder, micro-prism collar, full-area five focusing outer area with grid lines. **OTHER FEATURES:** Shutter speed-preferred automatic exposure control (you set shutter speed, camera determines aperture), with over-, underexposure, and beyond-meter-range warning LED just adjacent to finder area, low battery power and TTL flash ready and confidence LED above finder area, manual aperture control. Three silicon cells behind spectral-response compensating semi-silvered mirror read lower center-weighted area at working aperture, automatically compensating for extraneous light entering finder, ASA settings 25-6400. Additional photocell in mirror box reads flash exposure off film surface controlling dedicated handle-mount auto-flash. Combined depth-of-field preview/exposure-hold control couples to aperture readout on lens, on/off, sequence/single frame selector. Built-in motor drive provides up to 1.6 frames-per-sec. operation in sequence mode. Removable magazines with interchangeable film holding inserts have built-in dark slide, accept 120 and 220 films in 6x6 and 4.5x6 cm. and format and Polaroid packs. Film reminder clip, and automatic film advance to first frame and wind-up after last exposure. Built-in multi-contact socket accepts electronic cable release with mirror lock, ME-1 multi-exposure and intervalometer device and future accessories, all powered by interchangeable slide-in nicad battery; charger supplied with camera. **PRICE:** \$2,850 with 80mm f/2.8 Planar lens, strap and charger.

Just over 10 years ago, Rollei's all-electronic dream camera, the automatic, medium-format SLX was announced to the press. In 1977, it finally arrived on our shores and a complete, generally favorable test report appeared in *Modern Tests*, July 1977.

So now we have a new one, the Rolleiflex 6006; basically the same camera mechanically and electronically, but with improved control design, and restyled for better handling and easier operation. The biggest news is revealed by the modest 3/4 in. increase in overall depth. At first glance this is the only indication that the 6006 is blessed with a fully interchangeable roll film back (instead of the SLX's removable plastic film insert), a feature long desired by pros and amateurs alike.

Deep within the 6006's body lies an additional SPD photocell scanning the film plane and monitoring the output of Metz, Braun, Agfa, Oram and other flashes taking standard European dedicated flash modules. Smaller additions include a socket for mechanical cable releases placed between the two shutter releases now faired into the body design. All this has been achieved at a modest (\$338) price increase (to \$2850 list.), comparable with competitive medium-format SLRs which lack (still!) many of the automatic features of the Rollei 6006.

As before electromagnetically controlled in-lens shutters cover a speed range from 1/500th sec. down to 30 full sec., plus B, per-

mitting use of any shutter speed with flash for more controllable fill-in flash and background control. Since the interlens shutters and diaphragms are controlled by "linear motors" (not unlike solenoids), they can be operated without mechanical connections from the body, permitting fully automatic exposure and operation with tubes, bellows, and other accessories without the time delays often inherent in mechanical systems.

Film handling is particularly convenient. Rollfilm, either 120 or 220, is loaded into plastic pre-loadable plastic film inserts nearly identical to those used in the original SLX. Wind on until the arrow on the paper backing coincides with the loading arrow and then just pop it into the appropriate interchangeable magazine, either on or off the camera. A light touch on the shutter release winds the film to the first frame in a split second. After the final exposure, the film is wound automatically onto the take-up spool. To reload, just turn the insert end-for-end and thread in a new roll. There's no need to shift the empty spool. Since these are essentially the same inserts used in the original SLX and are moderately priced (\$42 each with a light-tight case), a batch can be pre-loaded for fast shooting with the same film type.

Unlike the SLX, however, the 6006's film magazines can be changed in mid-roll when you want to use different films, in successions or shoot Polaroids. The magazines are cleverly designed, feature a flexible dark slide that rolls around one end and never needs to be removed. The only way to lose this one is to lose the whole magazine (\$450 each, available for 6x6 and 4.5x6 cm. formats for 120 or 220.) The 6006, unlike the SLX, does not allow use of both 120 and 220 film in the same magazine. You win some and lose some, but relatively few photographers use the longer 220 rolls anyway.

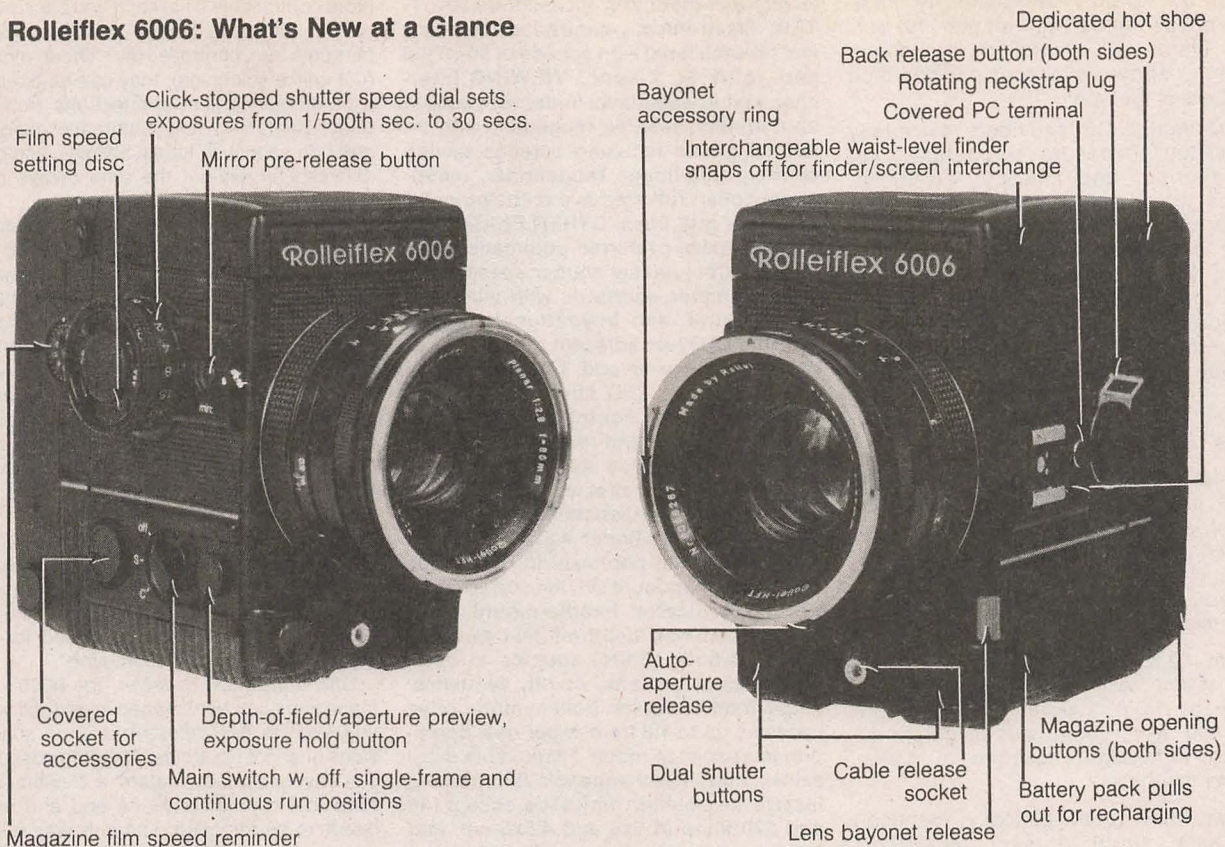
Happily the 6006's "User's Manual" is far more comprehensive than the sketchy booklet we got with the SLX. Using it as a guide, let's take you through the camera's many features.

Like the SLX, the 6006 is an elegant, massive camera. The styling is quite reminiscent of the original Rollei TLRs, all-time classics of the medium-format genre. The 6006 body, without back, is almost the size and shape of a classic Rollei, complete with fast-opening waist-level hood. All corners of the matte black die-cast aluminum body are elegantly rounded for comfortable handling, while heavy-ribbed rubber covers the bottom 1/3 of the body for easy grippability. In the redesign, most individual controls have been shaped for easier use. They "fall to hand and fingertips" quite readily and can be easily located and identified by touch. These little touches can mean a lot—especially when you've got to work fast.

There has been no visible change in the 6006's electrical system, although "only" 800 exposure sequences (metering, shutter release and automatic film advance) are now claimed for a fully charged 9.6-V nicad instead of the original 1000. The battery is the same as before, a powerful, fast rechargeable nicad about the size of a 35mm film box that fits in a slot on the camera's lower left side (when in shooting position.) It is locked securely into the body by a latching handle, yet, wearing gloves in cold weather, you can easily replace it with a spare. Since the battery contacts are female, it cannot be short-circuited when carried in a pocket. If



## Rolleiflex 6006: What's New at a Glance



the battery chills to 14°F (-10°C), its capacity is reduced to some 50 exposures so it's a good idea to keep it in a warm pocket. In very cold weather, photographers may opt for an accessory external battery connector and case and work off a permanently pocketed power source of the proper voltage.

The battery incorporates a special fuse (a spare is parked inside) to protect the camera's electronics. We blew a fuse when we intentionally mis-loaded the camera to check what would happen if the insert were popped in backwards. It raced frantically, trying to attract our attention, then blew the fuse. The right spares can be purchased at radio or automotive supply outlets but we warn you: Use a fuse of correct specs or damage will result!

The 6006 comes with the same adjustable input voltage high-speed charger supplied with the SLX. It may be set for AC voltages from 90 to 240 volts, has indicator lights to let you know the state of charge, and will accept an accessory cord to permit 14 hr. recharging from a 12-V car battery. An exhausted battery can be recharged to provide enough power for about 100 exposures in the first 10-15 min. of the rapid charge cycle. A battery can be fully recharged in as little as 1 hr. As with other nicad batteries, you must follow precisely the charging instructions to obtain optimum life; a replacement lists for \$90. An all-electronic camera requires a good power source—and this one is of high quality and unusually well thought out. With routine care, power supply should not pose any special problems.

It takes less than 30 sec. to change films and be ready to shoot again. For technical reasons, Rollei could not couple the film

speed dial on the magazines with the exposure system in the 6006 as they did with the SL 2000 F 35mm SLR and the new SL66 E focal-plane shutter medium-format SLR. It would have run afoul of the automatic exposure limit indication system in the camera and speed knob. As a result you must remember to change the film speed dial on the shutter-speed knob when necessary to correspond with the film you're using—a small but definite inconvenience.

When the dark slide is pulled out of the magazine aperture, the pressure plate extends nearly 3/8 in., pushing the film past body depth as the original SLX. We noted that Rollei specifically warns against the interchange of film inserts and backs with SLX cameras. Being curious, we got an early SLX and tried it. The new magazines will fit SLXs, potentially giving their owners the benefits of mid-roll film interchangeability. However, Rollei claims that minor mechanical changes should be made to ensure accurate film tracking. The 6006's film guides are scalloped to clear the film guide clips on the magazine pressure plates. However, on the SLX we tried, preliminary examination showed satisfactory film tracking and flatness. Rollei will factory modify existing SLXs to ensure film flatness and decrease possible friction and install switch contacts so that the camera will not fire with the darkslide closed. As it now stands, film may run through your SLX in a 6006 magazine correctly but you must remember to open and close the magazine slide appropriately, or it may blow the fuse. Note that the price of a new 6006 is less than the price of a new SLX plus a 6006 magazine, and remember, the 6006 also provides TTL autofocus.

The 6006's viewing and metering functions are almost identical to the SLX's, the only addition being the green charge and output-indicating LED just to the left of the red low battery warning LED at the top of the finder screen. The same, easy-opening waist-level hood is fitted—in fact, the same top-mounted accessories fit both cameras. The spring in the folding focusing magnifier has evidently been beefed up; there's no tendency for the magnifier to jam with the current hood. Magnification of the folding magnifier is 3.3X and light exclusion is excellent so the screen is clear of top light glare. Eyeglass wearers can see the whole frame by moving their eyes from side to side slightly. Pressure from eyeglass lenses can push the magnifier down if too much pressure is applied. A eye level sportsfinder is built into the hood and covers the viewing field of the 80mm lens slightly. A rigid magnifying hood with a focusable magnifier able to handle most eyesight peculiarities is available. Two rotating prism finders are available, a 90° model and a 45° model; both have rubber eye cups. The 45° prism tested was unusually light in weight, versatile and especially convenient for copying, and other odd angle work. With it, the 6006's steadiness and balance for long lens use is exemplary.

Focusing screens are easily cleaned or changed with the flip-up screen holder, and may be obtained in 5 types; ground glass, and laminate screens with grid, split image and grid, microprism, and clear center for macro/micro work. An extra frame with carrying case is also available to assist screen switchers.

The SLX, and, of course, the 6006 are still alone in the medium-format field in offering



shutter-preferred automatic exposure. To go into auto-exposure mode, lock the lens aperture at the "A" mark just beyond f/22. Beyond the double bayonet lens rim (inner for filters and the like, outer for hoods) is a knurled aperture setting ring, the aperture scale commendably clicked at 1/3 stop intervals for accurate manual settings, with the aforementioned "A" for automatic setting, and a white camera-selected aperture indicator behind a transparent window. When you're in manual mode, a red band covers the meter window. This is both good and bad. It makes it difficult (but not impossible) to shoot in manual mode by mistake unless you can't see the color red.

To go to manual, you press in a red stud on the bottom of the aperture ring and set any aperture you want but, because of the aforementioned red band, you can't see the camera-selected aperture. This is not much of a loss but you have to train yourself to read the recommended aperture just before switching to manual mode.

This brings us to Rollei's triple threat metering and aperture preview switch called the "combination test button". A single press of this microswitch, just behind the right hand shutter release memorizes the exposure (and locks the exposure indicator) while electronically stopping the lens down for easy depth-of-field preview. Letting up on the button reopens the diaphragm and unlocks the metering system to enable further readings. The convenience and control given by this single button has to be experienced to be fully appreciated. The dual shutter release switches along with the well-executed exposure hold control making it easily possible to scan a scene for exposure variations, pick a metering area, lock in the exposure, set the desired aperture by changing the shutter speed, or confirm the required depth of field and then squeeze off a shot. You never have to touch any control on the lens.

In short, the 6006 offers exemplary control in its automatic exposure mode. If you want to bracket, however, you must switch to manual mode. There's a back-light button or exposure-compensation dial (although you can change the ASA input settings if desired). In manual use you must remember to let up on the test switch between aperture changes. The diaphragm leaves do not follow the diaphragm ring until the switch is released momentarily. In automatic-exposure mode changing shutter speeds releases the diaphragm automatically so that it moves to an equivalent exposure setting.

Now let's take a picture. Set the aperture ring to "A", the mode selector to "S" for single frame, and the ASA value on the shutter speed knob. Now set a reasonable shutter speed. Turn the large, rubber-covered, solidly click-stopped knob so that the desired speed is on top, next to the indicator window close to the camera body. If this window is white, you know you're within the 6006's metering range. If it's red, you're beyond the limits of metering accuracy. The speed dial is very legibly marked in white-on-black with slow speeds between 1 and 30 sec. (and B) marked in green.

How do you know you've selected the right shutter speed? Open the viewing hood and press the round combination test button in front of the mode-selector dial. A light click tells you that the white aperture indicator is now pointing to the camera-selected aperture. Look at the right side of the screen. If

| GENERAL PERFORMANCE                   |                                                                                                                                                           |                                                    |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Checkpoints                           | Our Standard                                                                                                                                              | As Tested                                          |
| <b>FINDER:</b>                        |                                                                                                                                                           |                                                    |
| View area compared to film area       | Vertically and horizontally more than 90% less than 100%                                                                                                  | Vertical: 96%<br>Horizontal: 97%                   |
| Parallax error compared to film       | Vertical: 1.134mm<br>Horizontal: 1.122mm                                                                                                                  | Vertical: 0.1mm (Down)<br>Horizontal: .05mm (left) |
| Focusing accuracy at maximum aperture | Within depth of focus                                                                                                                                     | no discrepancy                                     |
| Image magnification                   | 3.3X                                                                                                                                                      | 3.4X                                               |
| <b>PICTURE SIZE:</b>                  | 56±1.4mm X 56±1.4mm                                                                                                                                       | 56.1mm X 56.7mm                                    |
| <b>SHUTTER:</b>                       |                                                                                                                                                           |                                                    |
| Camera insulation from sync           | More than 7 megohms                                                                                                                                       | Infinity                                           |
| Sync contact efficiency               | More than 60%                                                                                                                                             | 90% (PC) 80% (Hot Shoe)                            |
| Synchronizer delay time               | X: within full opening                                                                                                                                    | O.K.                                               |
| <b>CAMERA SIZE:</b>                   | Body: 4¼ in. wide X 5½ in. high (with folded finder) X 5 in. deep (with back) (108.8mm X 130.3mm X 127.2mm)<br>LENS: 2⅝-in. long, 3⅛-in. dia (60 X 81 mm) |                                                    |
| <b>WEIGHT:</b>                        | Body with waist level finder, magazine back and batteries: 3 lb. 4½ oz. (1492.2g)<br>LENS: 1 lb. 5 oz. (583g)                                             |                                                    |

you've selected an exposure time so long that overexposure is inevitable, a red LED near the top of the focusing screen will light up. If you've picked too high a speed for your largest aperture, a red LED near the bottom of the screen lights up. In either case, turn the shutter-speed dial toward the offending light to put it out. If both LEDs light simultaneously, then you're beyond metering range. Use manual settings in this case.

The red zone markings on the shutter-speed dial and the warning LEDs in the finder agreed perfectly in their warnings. Under these conditions we experienced no erratic behavior of the over/under/beyond exposure range warning system LEDs.

Like the SLX, the 6006 has twin ultra-smooth microswitch releases, one on each corner of the camera's front panel. Whether you focus with your right or left hand, there's a release and a corresponding camera hold for comfort and steadiness.

It's important to cultivate a grip that keeps the exposure combination test button conveniently to hand. You'll be using it as much as the shutter release(s). SLX users will find that the 6006's releases are now permanently mounted and cannot be removed to plug in remote releases, an unnecessary feature when the camera already has a multi-contact remote control terminal that will do practically everything. To make up for this minor lack, a convenient cable release socket for ordinary mechanical cable releases has been placed in the center of the body between the twin releases.

The softest progressive pressure fires the camera and a "clunk, whirr" announces that you've made the exposure and wound on to the next exposure. At 1/125 sec., you can expose a 12-exposure roll in 8 sec. flat so the duration between shots even in single exposure mode is a tad over half a sec., amply fast

for the most mercurial portrait subject. Twelve sec. will get you from "S" position through 12 shots, and wind on the film.

The camera's "clunk" is more bark than bite. The oversized pneumatic damper eliminates most of the mirror and baffle slap by the time the camera's ready for the next exposure in a sequence. The shock itself mostly occurs after the exposure is completed. Our lens tests showed no appreciable blurring due to shutter or mirror action. For those with lighter weight tripods, a convenient mirror pre-release button recessed into the body just in front of the shutter-speed knob makes things extra safe. And, with either the 16 in. Electric Hand Release, its 16 ft. big brother, the ME-1 Multi-Exposure Control, or the MM1 Electric Manual Release, you can pre-trip the mirror and control the shutter separately.

With the standard screen, horizontal rangefinder spot, microprism collar, and full-focusing fresnel screen with grid lines, focal lengths from 40 to 350mm focused with commendable speed and precision. Some darkening of the rangefinder spot was noted with the 350mm f/5.6 tele, and a trace of vignetting at the top of the ground glass, due to a slightly short mirror, was seen. There was, of course, no vignetting of the image on film. This is quite a normal occurrence when using extremely long teles with SLRs of all varieties. The finder was bright and the images snapped in and out of focus cleanly. The focusing system seemed flare-free so that the contrast of the viewing and focusing image was high and, hence, easy to focus even in the darker areas.

The lens release lock has now been slightly relocated and is topped by a red warning grip at the corner of the body just above the left hand shutter release. Pushing it straight in allows the lens to be removed with a 45°



## 2 1/4 Single Lens Reflex

counterclockwise turn. The camera's huge (3-in. wide) chromed brass bayonet mount is held by eight heavy screws and should cope with the large, heavy optics required by a medium-format system SLR. Before mounting a lens you've got to match an indented red dash on the rear of the lens mount with a red dot recessed into the camera front at the top of the mount. These dots and dashes can be difficult to see in subdued light. However, if you remember that the projecting electrical contact strip on the lens is inserted into the body at about 5 O'clock (viewed from the camera front), lenses can be mounted even in the dark by touch. A short, swift clockwise turn and you're mounted up, ready to fire.

Rollei's sturdy and precise lens mount is only part of the story. Ten spring-loaded gold-plated contacts rise from the bottom of the camera body like gold teeth. On the rear of each lens, a stepped block carries 10 matching gold-plated contacts designed to provide solid-electrical contact with the body when the lens is mounted. Missing from the mount are the customary arms, shafts, and levers used to control lens diaphragms and cock shutters in mechanically-controlled cameras.

All this is done electronically on the Rollei, regulated by the body's CPU (central processing unit) and driven by electromagnets. There are no pre-tensioned power springs in the lens units. The shutter speeds set on the speed dial and the apertures automatically selected by the metering system are conveyed to the lens units by these contacts. Synchronization of the shutter, mirror, shutter blind and film advance is provided electronically, orchestrated with the diaphragm operating cycle, and executed without cams, or springs. The system promises uncommon accuracy and reliability. Experience with SLXs over the years has confirmed their fine performance and excellent reliability. As an added bonus, the flexibility of the electronic system permits remote-control of aperture, mirror, shutter and film advance separately when desired. This allows unprecedented control over the camera at a distance using Rollei's sophisticated accessories.

Metering, control, and shutter-operating systems are basically identical to that of the original SLX, so we will not go into them in great detail. Suffice it to say that the sophisticated system permits shutter-preferred exposure automation of extraordinary accuracy and reliability. The electromagnet's ability to drive the mechanism precisely, and rapidly reverse its direction, enables accurate control of the shutter blades, while the diaphragm opens for focusing, closes all the way shut (so that the system can measure stray light from the finder), then begins to open the lens. When the light on the metering cells (minus the memorized stray light level value) reaches the intensity required for correct exposure with the shutter speed and film speed selected, the diaphragm stops opening, and the shutter fires. All this, of course, takes place while you're still pressing the microswitch release.

The SLX's metering system more than compares with its newer competitors with add-on aperture-preferred automation. But it is in actual photography that the camera proves its worth. The only fly in the original SLX ointment was the camera's lack of interchangeable backs, a necessity to many pros needing to change to different films in mid-roll or shoot a confirming Polaroid to ease art

directorial qualms. Now we not only have interchangeable backs, but auto-loading magazines that promise superior film flatness with interchangeable pre-loading inserts, with loss-proof built-in darkslides.

For contrasty scenes, keep in mind the lower center-weighted metering pattern and use the convenient exposure test button when necessary to hold exposures from selected scene areas. With long lenses, like the 350mm tested, the camera with its 45° prism rests in your arms with superb balance and is amazingly stable, partially because of the camera's hefty 4 lb. 9 oz. weight.

About all we could wish for would be a supplementary dry cell battery pack and a secondary exposure override dial linked to the film-speed setting so that long term subject corrections could be put into the computer without going into manual mode.

Although the Rollei 6006 offers an internal SPD-taking center-weighted exposure reading off the film surface itself to control flash duration along with an in-finder LED signaling flash charge and exposure sufficiency, we were unable to get the required coupling module to test it. We'll have to pass on the manufacturers claims to you and confirm them later. SCA 100 and SCA 356 Rollei modules will couple the 6006, the SL 2000F, and the new SL 66E with Metz, Braun, Osram and Agfa strobes and should be available now.

For normal flash work, the camera is used in manual mode, the flash provides sync at any speed-emitting only the precise amount of light needed for any aperture set, or signalling insufficient light in the finder. In automatic mode, the 6006 should automatically execute fill-in flash exposures, an unusual and potentially very valuable feature. The camera is said to provide the appropriate aperture for the shutter speed selected, read the flash through the stopped-down lens, and then terminated the flash for an approximately 1 to 1 flash fill ratio.

The possibilities of the ME 1 Multi-Exposure Control boggle the imagination. The compact control box is about the size of a jumbo pocket book and runs off the camera battery entirely. Dials permit setting the desired number of exposures wanted on single frame and the interval between them. Buttons permit independent control of the camera mirror (in manual mode) and exposure checking in automatic mode, along with LED camera status signals and an exposure counter reading as high as 999. Could a bulk film back be coming? You can confirm that the shutter is set correctly for the light level on the subject, retract the mirror and take single, or multiple exposures from distances as great as 32 ft. Up to 10 multiple exposures can be made at intervals from .1 to 1.5 secs. on a single frame.

By now, we have nearly the whole gamut of SLX/6006 accessories available. Extra inserts in light-tight cases, 120 and 220 magazines in two formats, Zeiss lenses from 40 to 350mm, Schneider 55mm PC lenses and a 140-280 zoom—even an automatic 2X converter. Two prism finders, a magnifying hood, regular and professional lens shades, battery inserts and external connectors, the long awaited ME-1 Multi-Exposure Control, Infrared Remote Release system, and Multi-Exposure release MM 1 are available. Pistol grips, levers for quick focusing, automatic, electronically-coupled extension tubes and bellows, copy attachments and even a gela-

tine filter holder, sweeten the pot.

Tested with the Rollei 6006 was the Rollei-made 80mm f/2.8 Planar, which we last checked in 1977 when we wrote about the Rollei SLX.

### PERFORMANCE

| Our Standard                                                                      | as Tested                |
|-----------------------------------------------------------------------------------|--------------------------|
| <b>Focal length:</b> + -5%<br>(76.00-84.00mm)                                     | 81.13mm                  |
| <b>Aperture:</b> + -5%<br>(f/2.66-2.94)                                           | f/2.87                   |
| <b>Distortion:</b><br>(+ -2%)                                                     | less than 1%<br>(barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.2 stops) | 1.0 stops                |

### RESOLUTION

| ROLLEI 80mm f/2.8<br>at 1: 20.32 |                  |                  |           |    |
|----------------------------------|------------------|------------------|-----------|----|
| f/                               | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 2.8                              | Excellent        | 46               | Excellent | 32 |
| 4                                | Excellent        | 51               | Excellent | 32 |
| 5.6                              | Excellent        | 64               | Excellent | 41 |
| 8                                | Excellent        | 64               | Excellent | 41 |
| 11                               | Excellent        | 64               | Excellent | 46 |
| 16                               | Excellent        | 58               | Excellent | 46 |
| 22                               | Excellent        | 58               | Excellent | 51 |

### CONTRAST

| ROLLEI 80mm f/2.8<br>at 30 lines/mm |               |               |        |    |
|-------------------------------------|---------------|---------------|--------|----|
| f/                                  | Center<br>(%) | Corner<br>(%) |        |    |
| 2.8                                 | High          | 48            | Low    | 16 |
| 4                                   | High          | 61            | Medium | 24 |
| 5.6                                 | High          | 60            | High   | 45 |
| 8                                   | High          | 60            | High   | 68 |
| 11                                  | High          | 61            | High   | 70 |
| 16                                  | High          | 61            | High   | 58 |
| 22                                  | High          | 58            | Medium | 28 |

**Optical bench analysis:** (for optical experts only) On axis, wide open, we found slight zonal spherical and slight over-corrected spherical aberration. Some flare wide open, no color fringing. Performance was almost at diffraction limits by f/5.6. Off-axis, the Planar showed slight coma wide open; gone by f/4. Slight astigmatism; almost gone by f/8. Just noticeable lateral color.

**Field test transparencies:** Our Ektachrome transparencies showed slight flare wide open; disappearing at f/4. Images were very sharp and crisp, even in the corners. Only a hint of lateral color was seen in corners. General slide quality, above average for a medium format normal lens. (February 1984)

## COMPACT ZEISS 350 TELE FOR ROLLEI 6006 AND SLX MODELS

**Specifications:** 350mm f/5.6 Zeiss Tele-Tessar; mount for Rollei SLX and 6006 SLRs; No. 6182270; accepts 86mm screw-in filters; f/5.6 to f/45, clicks at 1/3 stops; min. foc. dist. 5 m (16 ft. 5 in.); 8 1/8 in. long, x 3 1/8 in. diam. (227 x 90mm); 3 lbs. 11 oz. (1650 g.); \$2700.

**Practical comments:** Surprisingly well-balanced and compact for a 350 designed for the 2 1/4 x 2 1/4 format. Smooth rubber-



## PERFORMANCE

| Our Standard as Tested                                                     |                              |
|----------------------------------------------------------------------------|------------------------------|
| Focal length: $\pm 5\%$<br>(332.50-367.50mm)                               | 343.57mm                     |
| Aperture: $\pm 5\%$<br>(f/5.32-5.88)                                       | f/5.84                       |
| Distortion:<br>( $\pm 3.5\%$ )                                             | less than 1%<br>(pincushion) |
| Light falloff: at f/5.6<br>+1 stop from theoretical limit<br>(0-1.0 stops) | 0.8 stops                    |

## RESOLUTION

| ZEISS 350mm f/5.6<br>at 1: 19.84 |                  |    |                  |    |
|----------------------------------|------------------|----|------------------|----|
| f/                               | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 5.6                              | Excellent        | 50 | Excellent        | 35 |
| 8                                | Excellent        | 50 | Excellent        | 40 |
| 11                               | Excellent        | 50 | Excellent        | 40 |
| 16                               | Excellent        | 56 | Excellent        | 35 |
| 22                               | Excellent        | 50 | Excellent        | 32 |
| 32                               | Excellent        | 50 | Excellent        | 32 |
| 45                               | Excellent        | 44 | Excellent        | 32 |

## CONTRAST

| ZEISS 350mm f/5.6<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------|---------------|----|---------------|----|
| f/                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 5.6                                 | High          | 46 | High          | 30 |
| 8                                   | High          | 48 | High          | 51 |
| 11                                  | High          | 48 | High          | 48 |
| 16                                  | High          | 52 | High          | 50 |
| 22                                  | Medium        | 38 | High          | 46 |
| 32                                  | High          | 31 | High          | 42 |
| 45                                  | High          | 30 | High          | 41 |

covered diamond pattern focussing grip is a full 1-in. wide. Click-stopped diaphragm ring, calibrated in full-stops but clicked in 1/2 stops, engraved in white near camera body. Aperture for automatic exposure indicator in top of body. "A" indicator for auto mode operation, release stud in diaphragm ring at bottom. Depth of field scale legibly engraved in green deep screw-in lens shade allows access to Rollei 86 x 1mm filter and accessory thread. Cap covers hood. Tripod socket in camera body; none on lens but whole rig is well-balanced.

**Optical bench analysis:** (for optical experts only): On axis, we saw slight secondary telephoto aberration; gone by f/11. Performance near diffraction limits by f/22. Very slight red flare throughout. Off-axis, we saw slight high order aberration in corners; gone by f/22. Slight astigmatism and lateral color throughout. Performance still excellent for a telephoto

to formula.

**Field test slides:** Our 2 1/4 x 2 1/4 Ektachrome transparencies were sharp and crisp overall, improving even more stopped down to f/8. Flare was well-controlled and overall quality above-average. (February 1984)

## 2 1/4 RANGEFINDER

### THE GS645: FUJI'S FANCY FOLDER

**MANUFACTURER'S SPECIFICATIONS:** Fujica GS645 Professional, folding rangefinder camera for 15 exposures 2 1/4 x 1 1/8 in. (6x4.5cm) on 120 film, 30 exposures on 220 film. Body No. 2111675. LENS: 75mm f/3.4 EBC Fujinon S, No. determined by body, in non-interchangeable, double-helical mount, stops to f/22, focusing to 1 meter (39 in.). SHUTTER: Copal No. 00 between-lens leaf with speeds from 1-1/500 sec. plus T, X sync at all speeds, self-timer. VIEWING: Combined, coincidence-type range/viewfinder with projected, parallax- and field-size-compensating framelines. OTHER FEATURES: Built-in gallium photo-diode (GPD) meter cell behind semi-silvered mirror in finder, powered by two 1.5 volt alkaline-manganese batteries, is coupled with shutter speed, aperture and ASA scales to provide center-weighted readings with films ASA/ISO 25-1600; LED readouts in finder activated by partially depressing shutter release; automatic film stop and frame counter provide double- and blank-exposure prevention; integral hot shoe; film box end clip; shutter lock. PRICE: \$530.00.

Back in the late 1950's photographers had the choice of two excellent folding rangefinder cameras providing a 2 1/4 x 1 1/8 in. (6x4.5 cm) format on 120 roll film—the renowned Zeiss Super Ikonta A and the equally brilliant, if less well known, Konica Pearl IV. Both provided fine performance and a relatively large negative in a truly pocketable package, but the trend was away from folding cameras of all types (except for innumerable Polaroid models) and by the mid-60s, virtually all of them had vanished from the scene. Now, nearly 20 years hence, Fuji has brought out its own full-featured version of the 6x4.5cm format folding rangefinder roll film camera—the GS645.

How does the GS645 fit in among current and classic rangefinder, roll film folders? In a most intriguing manner. For starters, it's about one-third larger than its 50s counterparts, measuring in at 5 3/4 x 4 7/16 x 2 3/16 in. folded, extended to 4 3/4 in. deep in shooting position. However, the use of molded polycarbonate in such areas as its top and bottom covers and hinged bed/lens cover has kept its weight down to a modest 1 lb., 12 1/2 oz. sans batteries, and it will still slide quite easily into most overcoat and jacket pockets while ensconced in its soft pouch case.

In terms of its mechanical and optical design, the GS645 most closely resembles the aforementioned Konica Pearl IV which combined a very rigid front standard with hef-

ty, pivoting support braces on two sides of the lens, a unit-focusing, 5-element lens, and a true projected finder frame providing both parallax- and field-frame size compensation throughout its focusing range. This latter type of compensation decreases the size of the viewing field defined by the framelines as the lens is focused closer, correcting for its narrower coverage angle at closer focusing distances. As a result the Fuji's finder shows almost exactly what appears on film irrespective of the focusing distance.

The GS645's large .63X life-size magnification range/viewfinder (which provides a claimed 90% field of view at infinity, 92% at 1 meter) has 3 metering LEDs along the right-hand edge. It's the principal reason the camera is so much taller than its predecessors. The metering system itself hews rather closely to the one found in the Plaubel Makina 67s, with a gallium photo-diode (GPD) placed behind a semi-silvered mirror in the finder. It's fully coupled to the shutter speed and aperture controls and provides match-diode metering. We'll go through its operation a bit later on.

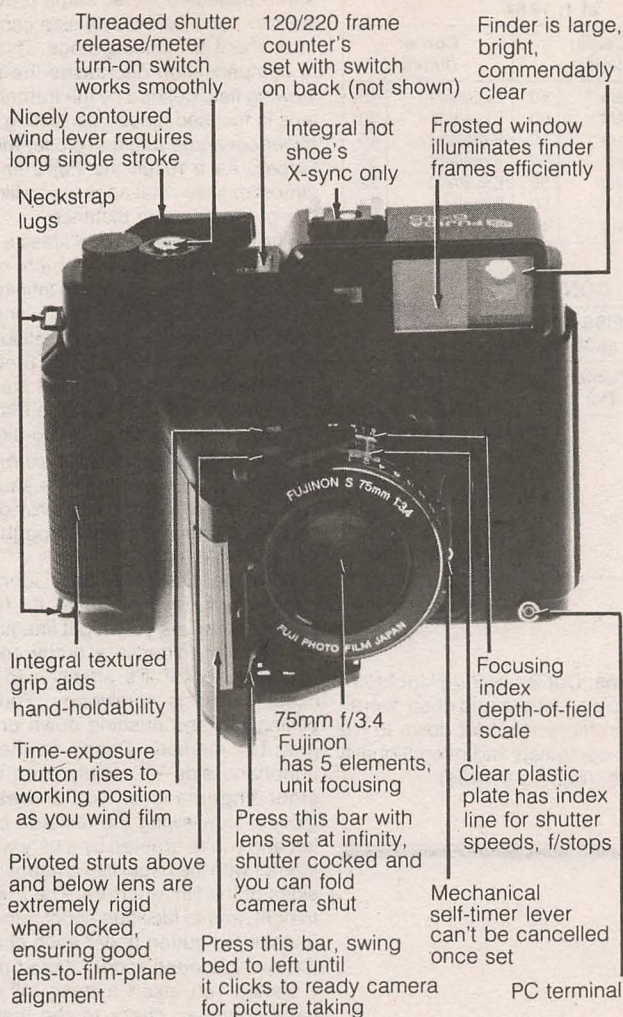
With the GS645's basic identity firmly established, let's examine its features in greater detail. As you might imagine, loading any roll film folder is a pretty conventional operation, but Fuji's attention to improving minor details is noteworthy. You begin by pulling out and pushing down on a hinged gray tab marked "Open" on the camera's right-hand side—it's easy even if you lack stout fingernails or you're wearing light gloves. Now swing the textured back to the left and you're greeted by a very well finished interior with the usual film chambers on either sides of the film aperture. The Fuji loads left to right, and to facilitate spool removal, press a small red button under each chamber and the spring-loaded spool retainer pops down.

Before you insert a fresh roll in the left-hand chamber, check to see that the pressure plate is set to "120" or "220" to match the film you're using—if it isn't, press the pressure plate in and slide it to the left or right as required. Then set the frame counter selector (it's located about 2 1/2 in. to the right of the finder eyepiece on the Fuji's back) for either 120 (15 exposures) or 220 (30 exposures) film. Finally, insert the film and take-up spool, push up the spool retainers until they click into place, thread the paper leader, and stroke the wind lever until the vertical arrow on the paper backing coincides with a down-pointing silver arrow atop the film aperture, close the back and stroke the film-wind lever until the counter adjacent to the shutter release moves from "S" to 1, at which point the wind lever will stop.

Before you can take a picture you've got to do two more things—unfold the camera and set the film speed. To open the GS645 press in on a gray "bar" on the front of the folded camera and swing the hinged bed to the left until it locks in place with a soft click. Now direct your attention to the three main control rings around the front of the lens barrel. The one closest to the front of the lens is the shutter-speed scale, which is adorned with large, legible white-on-black numerals from 1 to 500 and has click-stops at each setting. Directly behind it is the aperture ring, which has equally large and legible yellow-on-black f/stops from f/3.4 (a strange aperture that!) to f/22 and has no click-stops whatsoever. The ASA readout window is about half an inch to the left of the f/3.4 setting on the aperture



## What's New At A Glance? Fujica GS645



ring but the ASA-setting ring itself can easily be missed without a scorecard or instruction manual—it's a thin ring in between the shutter speed and aperture rings that's attached to the latter. At one point it terminates in a little hump with a fingernail slot in the middle and to set the proper ASA you've got to move it back and forth until the proper digits click into position. It's quite simple once you're used to it.

As you've probably figured out by now, the third or rear-most control ring near the front of the Fuji's lens is the focusing ring which moves the entire lens back and forth for focusing, an arrangement that's optically superior to the front-cell-focusing system used in other folding rangefinder cameras, notably the Zeiss Super Ikonta A. The Fuji's focusing ring has a very comfortable milled finger notch that can be easily manipulated with your right thumb or forefinger irrespective of the distance set. The focusing ring moves about 120° counterclockwise to focus the lens from infinity down to 1 meter and its action is wonderfully smooth and predictable. Inscribed on the front standard just behind the focusing scale is the main focusing index, infrared focusing index and a 5-aperture depth-of-field scale.

As long as we're up at the front of the camera, let's glance at two small but important features. With the Fuji held in the normal (vertical format) position, look about an inch

to the right of the depth-of-field scale and you'll find a little square red-bodied, black-topped button marked "T." It rises only when the shutter is cocked and when you press it in, the shutter stays open. This is accomplished via a mechanical linkage, so no battery power is wasted during long time exposures. To terminate a time exposure, just press the normal round, threaded shutter release atop the camera. Another "old fashioned" feature is located on the left-hand side of the lens barrel, just behind the aperture ring. It's a spring-wound mechanical self-timer that's set by moving a very vintage looking little chrome lever downwards in a short arc. Once you do this, you'll get a delay of about 8 sec. the next time you press the shutter even if you change your mind. Like the self-timers of old, this one's non-cancellable. Also, the little cutaway area through which the lever moves is a potential entry point for dirt or dust. It's not a big deal, but it is unfortunate in an otherwise well sealed body.

As long as we're griping, we may as well point out that we were less than thrilled at having to wind the film-advance lever and set the lens to infinity before being able to fold the camera shut. Aside from the nuisance factor, we are not in favor of storing cameras with their shutters cocked for long periods, or of storing folding cameras in their vulnerable open position. Oh well—at least the unlocking bar (it's marked "close" and located

behind the gray "opening latch") is conveniently placed and functions flawlessly when folding the Fuji.

Fortunately for Fuji fans, all carping is likely to cease once you raise the GS645 to eye level and start to take pictures. The range/viewfinder is superb—perhaps the best one ever fitted to a folder of this format. It has a slight bluish tint and since about 75 percent of the light passing through it is siphoned off for metering, it's not dazzlingly bright. However, it's certainly bright enough even for available light shooting in dim light and it's extraordinarily clear and contrasty at all times. The round, yellow focusing patch in the center provides a very bright, contrasty, well differentiated secondary image that's almost in the Leica M-series class, and the thin-lined yellow field frame is extremely bright and well defined even under the most unfavorable shooting conditions. The fact that its magnification is 2/3 lifesize also means you can view and focus with both eyes if you prefer, but eyeglass wearers will be able to see the entire frame.

Equally pleasant and well thought out is the Fuji's metering system. Once you've set your ASA and chosen a shutter speed, bring the camera to eye level, partially depress the shutter release, and simultaneously turn the aperture ring until the circular red LED at the midpoint of the right-hand finder edge, just outboard of the finder frameline, lights up. If only the circular LED lights, you've set the correct exposure right on the nose according to the metering system. Overexposure is indicated by a red (+) sign above the circular LED and underexposure is indicated by a minus sign (–) below it. If either the plus or minus barely glows while the circular LED is brightly lit this indicates over- or underexposure of 1/3 stop respectively; if the circular LED is barely lit while the plus or minus glows brightly this indicates over- or underexposure of about a stop. The nicest thing about Fuji's system, in addition to its being very accurate, is that it's commendably sensitive without being finicky. In other words, it allows you to meter accurately to within 1/3 stop without suffering from the "LED flutters."

There is only one thing about metering with the Fuji that's mildly annoying until you get used to it and that's grabbing and manipulating the aperture ring. Unlike the focusing ring, it's not blessed with a large finger grip, and the knurling on its bottom surface (the only part without a numerical scale) is fairly shallow. This means you must instead place your fingertip atop a tiny black lug to the left of the ASA window to get enough purchase to turn the ring properly. There's a nearly identical ring in about the same place on the shutter-speed ring, probably because it's also shallowly knurled on its bottom. We can appreciate that this area of the camera is perforce crowded with major controls but we wish Fuji had devised more comfortable finger grips and/or better differentiated knurling. We must admit, however, that we did get used to operating the Fuji by feel quite efficiently after a few days shooting with it.

Speaking of feel, this is another area in which the GS645 really scores well. The righthand side of the body is broadened to form a very effective, textured grip, and the shutter release and wind lever are both well positioned for comfortable use. We found the wind lever very comfortably contoured also, although we would have preferred it to be ratcheted so it could be operated in two short



## PERFORMANCE

| Our Standard                                                                      | As Tested                    |
|-----------------------------------------------------------------------------------|------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(71.25-78.75mm)                                 | 74.42mm                      |
| <b>Aperture:</b> $\pm 5\%$<br>(f/3.23-F/3.57)                                     | f/3.52                       |
| <b>Distortion:</b><br>( $\pm 2\%$ )                                               | less than 1%<br>(pincushion) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.6 stops) | 1.6                          |

## RESOLUTION

| FUJINON 75mm f/3.4<br>at 1:22 |                  |    |                  |    |
|-------------------------------|------------------|----|------------------|----|
| f/                            | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 3.4                           | Excellent        | 50 | Excellent        | 40 |
| 4                             | V. Good          | 50 | Excellent        | 40 |
| 5.6                           | Excellent        | 64 | Excellent        | 45 |
| 8                             | Excellent        | 71 | Excellent        | 50 |
| 11                            | Excellent        | 64 | Excellent        | 50 |
| 16                            | Excellent        | 56 | Excellent        | 50 |
| 22                            | Excellent        | 56 | Excellent        | 50 |

## CONTRAST

| FUJINON 75mm f/3.4<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------|---------------|----|---------------|----|
| f/                                   | Center<br>(%) |    | Corner<br>(%) |    |
| 3.4                                  | High          | 69 | High          | 34 |
| 4                                    | High          | 80 | High          | 40 |
| 5.6                                  | High          | 90 | High          | 62 |
| 8                                    | High          | 98 | High          | 66 |
| 11                                   | High          | 90 | High          | 84 |
| 16                                   | High          | 89 | High          | 70 |
| 22                                   | High          | 80 | High          | 70 |

strokes instead of one rather long 180° stroke. We also found the GS645 to be exceptionally well balanced, so much so that a photographer with a steady grip should be able to shoot sharp pictures at 1/30 sec. or even a bit slower. The very smooth, predictable shutter release would be a definite asset in available light shooting. It requires but moderate finger pressure to fire the shutter yet we were never in any doubt as to how much additional pressure was required to shoot the picture, and we never fired the shutter mistakenly while metering. Incidentally, the above reference to low light shooting is not an idle one—we found the GS645 comfortably exceeded its official specs and would meter accurately down to about 1/2 sec. at f/3.4 with ASA 400 film.

All in all we were quite taken with Fuji's answer to the classic rangefinder roll film camera and we were delighted with its performance, practicality and portability. While the word "Professional" that's emblazoned in full green on its front is certainly appropriate when you consider its optical and mechanical performance, this is really a fun camera that shows what happens when an "old fashioned" pocketable medium-format concept is intelligently updated. Undoubtedly, pros in search of a pocketable medium-format, non-interchangeable-lens alternative will go for it (indeed, many already have) but so will advanced amateurs who appreciate the advantages of a large film size in a camera with real character. Yes, that's it, character. Its foibles may annoy at first, but once you've gotten beyond them, shooting with a camera having a distinctive personality to complement its fine performance is a unique and pleasurable experience.

## GENERAL PERFORMANCE

| Checkpoints                              | Our Standard                                                                                           | As Tested                                         |
|------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>FINDER:</b>                           |                                                                                                        |                                                   |
| Rangefinder viewing distance             | Between infinity and 20 in. (0.5m)                                                                     | 59 in. (1.5m)                                     |
| Apparent distance of LED exposure signal | Between 79 in. (2.0m) and 39 in. (1.0m)                                                                | 20 in. (0.5m)                                     |
| Apparent distance of parallax scale      | Same as above                                                                                          | 39 in. (1.0m)                                     |
| View area compared to film area          | Vertically and horizontally more than 85%, less than 100%                                              | Vertical: 85%<br>Horizontal: 89%                  |
| Parallax error compared to film          | Vertical: 3.0mm<br>Horizontal: 3.0mm                                                                   | Vertical: 0.9mm (up)<br>Horizontal: 0.8mm (right) |
| Focusing accuracy at maximum aperture    | Within depth of focus                                                                                  | No Discrepancy                                    |
| Image magnification                      | 0.63 $\pm$ 0.1X                                                                                        | 0.625X                                            |
| <b>PICTURE SIZE:</b>                     | 56 $\pm$ 1.4mm X 41.5 $\pm$ 1.04mm                                                                     | 56.3mm X 42.5mm                                   |
| <b>SHUTTER:</b>                          |                                                                                                        |                                                   |
| Insulation from sync                     | More than 7 megohms                                                                                    | Infinity                                          |
| Sync contact efficiency                  | More than 60%                                                                                          | 81% (pc) 78% (hot shoe)                           |
| Sync delay time                          | X: within full opening                                                                                 | Okay                                              |
| Self timer delay                         | 7-15 sec.                                                                                              | 8 sec.                                            |
| <b>CAMERA SIZE:</b>                      | Body: 5 $\frac{3}{4}$ in. wide, 4 $\frac{7}{16}$ in. high, 2 $\frac{1}{2}$ in. deep (147 X 114 X 55mm) |                                                   |
| <b>WEIGHT:</b>                           | Body: 1 lb. 13 $\frac{13}{16}$ oz. (840g) with batteries                                               |                                                   |

**Field test slides:** Images appear crisp and snappy at all apertures, but sharpness improves noticeably at f/5.6 and smaller apertures. Color fringing barely noticeable in corners. Flare well controlled overall.

**Optical bench analysis** (for optical experts

only): On axis, diffraction limited by f/8, very slight overcorrected spherical aberration gone by f/8. Off axis, very slight coma, gone by f/5.6, slight lateral color overall. (June 1984)

# INTER-CHANGEABLE LENSES

## AETNA-ROKUNAR MACRO WIDE ANGLE

**Specifications:** 28mm f/2.8 Aetna-Rokunar, No. 911215, available in most SLR mounts, accepts 52mm accessories; f/2.8 to f/22, detents at full stops; min. foc. dist. 3 in. (macro), 1:4 scale, 2 in. long, 7-1/2 in. diameter, 8 oz., \$89.95.

**Practical comments:** The first Korean-made lens to pass muster in MODERN'S test lab, 28mm Rokunar has macro magnification scale clearly engraved in orange, distance scale in white (ft) and green (m), aperture-preferred operation lock symbol in green, white depth-of-field scales f/5.6-22 in white. Rubber focusing

ring at one-quarter inch wide is a bit narrow, but raised diamond pattern allows positive grip and smooth operation. Lens is average size for this focal length. Focused accurately and images snapped into focus clearly at all distances.

**Field test slides:** Slides were crisp, snappy; wide open, corners slightly soft, improved one stop down. Corners equalled center sharpness by f/5.6. Light falloff wide open almost gone by f/4. Very slight barrel distortion noted. Flare well controlled. Macro quality average. Overall an average lens for this type.

**Optical bench report:** On axis, very slight over-corrected spherical with slight focus shift almost gone by f/8. Diffraction limited by f/11. Off axis, very slight coma mixed with slight astigmatism, almost gone by f/16. Slight lateral color.



## Interchangeable Lenses

### PERFORMANCE

| Our Standard                                                                            | As Tested      |
|-----------------------------------------------------------------------------------------|----------------|
| <b>Focal length:</b> $\pm 5\%$<br>(26.60–29.40mm)                                       | 28.21mm        |
| <b>Aperture:</b> $\pm 5\%$<br>(f/2.66–2.94)                                             | f/2.82         |
| <b>Distortion:</b><br>28mm: ( $\pm 2.5\%$ )<br>0mm: ( $\pm 4\%$ )                       | 1.67% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>28mm: (0–2.0 stops) | 1.0 stop       |

### RESOLUTION

| AETNA-ROKUNAR 28mm f/2.8<br>at 1:50 |               |               |           |    |
|-------------------------------------|---------------|---------------|-----------|----|
| f/                                  | Center (l/mm) | Corner (l/mm) |           |    |
| 2.8                                 | Good          | 45            | Excellent | 40 |
| 4                                   | V. Good       | 50            | Excellent | 40 |
| 5.6                                 | V. Good       | 50            | Excellent | 45 |
| 8                                   | V. Good       | 56            | Excellent | 50 |
| 11                                  | Excellent     | 63            | Excellent | 50 |
| 16                                  | Excellent     | 56            | Excellent | 50 |
| 22                                  | V. Good       | 50            | Excellent | 45 |

### CONTRAST

| at 30 lines/mm |            |            |        |    |
|----------------|------------|------------|--------|----|
| f/             | Center (%) | Corner (%) |        |    |
| 2.8            | V. Low     | 25         | Low    | 20 |
| 4              | Low        | 35         | Medium | 25 |
| 5.6            | Medium     | 53         | Medium | 41 |
| 8              | High       | 67         | High   | 54 |
| 11             | High       | 63         | High   | 50 |
| 16             | High       | 48         | Medium | 34 |
| 22             | Low        | 38         | Low    | 24 |

## FAST 35-70mm ZOOM FROM ANGENIEUX

**Specifications:** 35-70mm f/2.5-3.3 Angenieux 2x35 Zoom; mounts for Canon, Leica, Minolta, Olympus, and Pentax K; No. 1479470; accepts 58mm accessories; f/2.5-3.3 to f/22 plus AE, 1/2 stop detents; min. foc. dist. 1.5 ft. (.46m); max. magnification 1:5.6 at 70mm; 4 3/4 in. long, 2 3/4 in. diam. (123mm x 70mm); 1 lb. 4 1/2 oz. (582 g); \$1100.00.

New mechanical design heralds serious re-entry of France's pioneering motion picture zoom lens maker into the still camera lens arena. Unusual in design and manufacture (it's guaranteed against defects in materials and workmanship and comes with an all-risk one year insurance policy protecting against loss, theft, or damage). All this comes at a premium price. Is the high cost justified? Yes. See analysis and data for details.

**Practical comments:** Far from the smallest 35-70mm zoom, the Angenieux is, nevertheless, light and well-balanced. Twin-ring controls with fluted gripping surfaces set focal lengths between 35 and 70mm, focus to 14 1/2 in. at all focal lengths; lightweight high-tensile strength Polycarbonate body shell with integral fluted focusing and zooming grips for easy handling and excellent fit. Being a twin-ring design, lens focus and focal length settings stayed put, in any lens positions. Focus, zoom and aperture scales are in white and gold, red depth-of-field scale slightly hard to read. Lens front elements recede deeply into

barrel as lens zooms to long focal lengths, adding to the effectiveness of the snap-on rectangular hood provided. Since the filter mounting ring does not rotate in focusing or zooming Cokin P filters can be fitted, and use of polarizing filters is made easy. Focus and zoom changes do not affect the length of the lens, so handling is easy. Lens is shipped in a nitrogen-filled bag said to protect it in shipment, enclosed in a fitted presentation case with a lens pouch, haze filter, shade and Cokin adapter.

Although the Angenieux's 2:1 zoom range is modest, the test results indicate that it's performance is well above average.

**Field test slides:** Transparencies sharp and snappy from center to corners at all apertures. Contrast and sharpness of fine details was exemplary throughout. Performance holds up well at close-working distances. Slight barrel distortion was noticeable at wide settings. Flare was well-controlled at all apertures.

**Optical bench analysis:** (for optical experts only): At 35mm, on axis, we saw slight flare wide open. Sharpness was diffraction limited by f/5.6. Slight lateral color throughout.

At 50mm, on axis, slight flare wide open, very slight under-corrected spherical aberration, peak performance by f/5.6. off axis, same as 35mm.

At 70mm, performance same as shorter focal length settings. Diffraction limit reached by f/11. Off axis, slight astigmatism and coma disappeared by f/8. Slight lateral color throughout. (June 1984)

### PERFORMANCE

| Our Standard                                                                                                   | as Tested                               |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(33.25-36.75mm)<br>(66.50-73.50mm)                                           | 36.30mm<br>68.47mm                      |
| <b>Aperture:</b> $\pm 5\%$<br>(f/2.38-2.63)<br>at 70mm: (f/3.14-3.47)                                          | f/2.61<br>f/3.47                        |
| <b>Distortion:</b><br>35mm: ( $\pm 2.5\%$ )<br>70mm: ( $\pm 2\%$ )                                             | 2.05% (barrel)<br>less than 1% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>70mm: (0-1.3 stops) | 1.1 stops<br>1.1 stops                  |

### RESOLUTION

| ANGENIEUX 35-70mm f/2.5-3.3<br>at 35mm<br>at 1:49 |               |               |           |    |
|---------------------------------------------------|---------------|---------------|-----------|----|
| f/                                                | Center (l/mm) | Corner (l/mm) |           |    |
| 2.5                                               | V. Good       | 49            | Excellent | 44 |
| 4                                                 | Excellent     | 62            | Excellent | 44 |
| 5.6                                               | Excellent     | 69            | Excellent | 49 |
| 8                                                 | Excellent     | 69            | Excellent | 49 |
| 11                                                | Excellent     | 69            | Excellent | 49 |
| 16                                                | Excellent     | 62            | Excellent | 44 |
| 22                                                | Excellent     | 55            | Excellent | 44 |

### CONTRAST

| ANGENIEUX 35-70mm f/2.5-3.3<br>at 35mm<br>at 30 lines/mm |            |            |      |    |
|----------------------------------------------------------|------------|------------|------|----|
| f/                                                       | Center (%) | Corner (%) |      |    |
| 2.5                                                      | High       | 62         | High | 30 |
| 4                                                        | High       | 58         | High | 40 |
| 5.6                                                      | High       | 88         | High | 53 |
| 8                                                        | High       | 80         | High | 53 |
| 11                                                       | High       | 78         | High | 50 |
| 16                                                       | High       | 74         | High | 48 |
| 22                                                       | High       | 73         | High | 41 |

### RESOLUTION

| ANGENIEUX 35-70mm f/2.5-3.3<br>at 50mm<br>at 1:51 |               |               |           |    |
|---------------------------------------------------|---------------|---------------|-----------|----|
| f/                                                | Center (l/mm) | Corner (l/mm) |           |    |
| 2.8                                               | Excellent     | 57            | Excellent | 45 |
| 4                                                 | Excellent     | 64            | Excellent | 45 |
| 5.6                                               | Excellent     | 72            | V. Good   | 45 |
| 8                                                 | Excellent     | 72            | Excellent | 51 |
| 11                                                | Excellent     | 64            | Excellent | 51 |
| 16                                                | Excellent     | 64            | Excellent | 51 |
| 22                                                | V. Good       | 51            | Excellent | 45 |

### CONTRAST

| ANGENIEUX 35-70mm f/2.5-3.3<br>at 50mm<br>at 30 lines/mm |            |            |        |    |
|----------------------------------------------------------|------------|------------|--------|----|
| f/                                                       | Center (%) | Corner (%) |        |    |
| 2.8                                                      | High       | 45         | Medium | 30 |
| 4                                                        | High       | 64         | High   | 43 |
| 5.6                                                      | High       | 72         | High   | 42 |
| 8                                                        | High       | 69         | Medium | 39 |
| 11                                                       | High       | 62         | Medium | 38 |
| 16                                                       | High       | 54         | Medium | 37 |
| 22                                                       | High       | 48         | Medium | 37 |

### RESOLUTION

| ANGENIEUX 35-70mm f/2.5-3.3<br>at 70mm<br>at 1:50 |               |               |           |    |
|---------------------------------------------------|---------------|---------------|-----------|----|
| f/                                                | Center (l/mm) | Corner (l/mm) |           |    |
| 3.3                                               | V. Good       | 45            | Excellent | 45 |
| 4                                                 | Good          | 45            | Excellent | 45 |
| 5.6                                               | V. Good       | 56            | Excellent | 45 |
| 8                                                 | Excellent     | 63            | Excellent | 50 |
| 11                                                | Excellent     | 56            | Excellent | 50 |
| 16                                                | Excellent     | 56            | Excellent | 50 |
| 22                                                | V. Good       | 50            | Excellent | 45 |

### CONTRAST

| ANGENIEUX 35-70mm f/2.5-3.3<br>at 70mm<br>at 30 lines/mm |            |            |        |    |
|----------------------------------------------------------|------------|------------|--------|----|
| f/                                                       | Center (%) | Corner (%) |        |    |
| 3.3                                                      | High       | 42         | Low    | 20 |
| 4                                                        | High       | 58         | Medium | 31 |
| 5.6                                                      | High       | 66         | Medium | 33 |
| 8                                                        | High       | 65         | Medium | 34 |
| 11                                                       | High       | 59         | Medium | 30 |
| 16                                                       | High       | 52         | Low    | 29 |
| 22                                                       | High       | 41         | Low    | 28 |

## 70-210mm f/3.5 ANGENIEUX ZOOM

**Specifications:** 70-210mm f/3.5 Angenieux 3x70 zoom, No.1502494; fixed mounts for Canon, Leica-R, Minolta, Nikon, Olympus and Pentax-K; accepts 62mm threaded filters; f/3.5 to f/22; detents at half and full stops; min. foc. dist. 3 ft. (.9m), 1:2.5 magnification at 210mm; 6 5/8-in. long, 2 3/4-in. diam. (168x71mm); 27.5 oz.(780g); \$1194, in leather box with pouch, shade and haze filter.

**Practical comments:** High speed yet surprisingly light lens made possible by judicious use of plastics in external lens barrel parts including focusing and zoom rings. Matte black finish. Front-mounted 2 1/2-wide, straight knurled zooming ring and rear-mounted 1 7/8-in. wide focusing ring at the balance point. Focusing scales very legible in yellow for feet, white for meters. Continu-



ous focus to macro range, usable at every focal length. No focus or zoom creep pointing up or down.

**Field test slides:** Slides were crisp with detail well-rendered. Wide open, at 70mm, slight color fringing and softness was noted; disappeared when stopped down two stops. At 120 and 210mm settings, corners equalled center sharpness by f/5.6. Under extreme lighting conditions (sun in corner of field), flare can effect contrast at maximum aperture. Overall, above average performance for a zoom of this focal length range.

**Optical bench analysis** (for optical experts only): At 70mm, on axis, very slight chromatic aberration was seen, gone two stops down. Very slight over-corrected spherical aberration was noted. Pattern diffraction limited by f/11. Off axis, very slight skew-ray flare mixed with very slight astigmatism and lateral color.

At 120mm, on axis, very slight chromatic aberration seen, gone when stopped down two stops. Very slight over-corrected spheri-

cal aberration seen. Diffraction limited by f/16. Off axis, very slight skew-ray flare mixed with very slight coma, some lateral color visible.

At 210mm, on axis, very slight chromatic aberration, gone two stops down. Very slight over-corrected spherical seen. Diffraction limited by f/16. Off axis, very slight coma, very slight astigmatism and lateral color. (March 1986)

#### RESOLUTION

| ANGENIEUX 70-210mm f/3.5<br>at 120mm<br>at 1:50 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/                                              | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                             | Excellent        | 50 | Excellent        | 45 |
| 5.6                                             | Excellent        | 56 | Excellent        | 50 |
| 8                                               | Excellent        | 63 | Excellent        | 56 |
| 11                                              | Excellent        | 70 | Excellent        | 63 |
| 16                                              | Excellent        | 63 | Excellent        | 56 |
| 22                                              | Excellent        | 56 | Excellent        | 50 |

#### CONTRAST

| ANGENIEUX 70-210mm f/3.5<br>at 120mm<br>at 30 lines/mm |            |    |            |    |
|--------------------------------------------------------|------------|----|------------|----|
| f/                                                     | Center (%) |    | Corner (%) |    |
| 3.5                                                    | High       | 46 | High       | 35 |
| 5.6                                                    | High       | 60 | High       | 50 |
| 8                                                      | High       | 66 | High       | 57 |
| 11                                                     | High       | 62 | High       | 50 |
| 16                                                     | High       | 58 | High       | 47 |
| 22                                                     | High       | 42 | Medium     | 35 |

#### RESOLUTION

| ANGENIEUX 70-210mm f/3.5<br>at 210mm<br>at 1:50 |                      |    |                      |    |
|-------------------------------------------------|----------------------|----|----------------------|----|
| f/                                              | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 3.5                                             | Excellent            | 50 | Excellent            | 45 |
| 5.6                                             | Excellent            | 56 | Excellent            | 50 |
| 8                                               | Excellent            | 63 | Excellent            | 56 |
| 11                                              | Excellent            | 70 | Excellent            | 63 |
| 16                                              | Excellent            | 63 | Excellent            | 56 |
| 22                                              | Excellent            | 56 | Excellent            | 50 |

#### CONTRAST

| ANGENIEUX 70-210mm f/3.5<br>at 210mm<br>at 30 lines/mm |            |    |            |    |
|--------------------------------------------------------|------------|----|------------|----|
| f/                                                     | Center (%) |    | Corner (%) |    |
| 3.5                                                    | High       | 45 | High       | 35 |
| 5.6                                                    | High       | 61 | High       | 51 |
| 8                                                      | High       | 67 | High       | 67 |
| 11                                                     | High       | 60 | High       | 51 |
| 16                                                     | High       | 57 | High       | 48 |
| 22                                                     | High       | 41 | Medium     | 33 |

### FAST 135mm f/2 TELE FROM CANON

**Specifications:** 135mm f/2 Canon FD, No. 20172 in Canon FD mount; accepts 72mm accessories; f/2-32 plus locked "A" (auto-exposure) setting; half-stop detents throughout; min foc. dist.: 4½ ft. (1.3m); 6 elements, 5 groups; 3-9/16-in. long, 3-in. diam. (90.4 x 75mm); 1 lb., 7 oz. (660g) \$460.00.

**Practical comments:** Relatively large and heavy for a 135 due to its wide f/2 aperture, but balances well on medium and large size Canon SLRs; excellent shiny black finish; focuses from infinity to min. foc. dist. in smooth

### Interchangeable Lenses

260° clockwise turn of ¼-in. wide rubberized textured focusing collar; all scales large and legible in white-on-black except green-on-black footage scale; built-in collapsible hood has black flocking on interior surface, effective in minimizing glare when shooting against the light.

**Field test slides:** Transparencies crisp and snappy with detail well rendered at all apertures and focusing distances. Corner sharpness equalled center by f/5.6. Slight pincushion distortion noted. Flare well controlled throughout. Overall, above average performance for a high-speed tele.

**Optical bench analysis:** On axis, slight undercorrected spherical aberration and primary chromatic aberration. Diffraction limited pattern by f/8. Off axis, slight high order coma mixed with slight astigmatism; minimal lateral color. (June 1986)

#### PERFORMANCE

| Our Standard                                                                       | as Tested      |
|------------------------------------------------------------------------------------|----------------|
| <b>Focal length:</b> ±5%<br>(128.25-141.75mm)                                      | 135.88mm       |
| <b>Aperture:</b> ±5%<br>(f/1.90-2.10)                                              | f/2.06         |
| <b>Distortion:</b><br>(±2.5%)                                                      | 0.9% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>(0-1.1 stops) | 0.5 stops      |

#### RESOLUTION

| CANON 135mm f/2<br>at 1:50 |                      |    |                      |    |
|----------------------------|----------------------|----|----------------------|----|
| f/                         | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 2                          | Excellent            | 50 | Excellent            | 45 |
| 2.8                        | Excellent            | 56 | Excellent            | 50 |
| 4                          | Excellent            | 63 | Excellent            | 56 |
| 5.6                        | Excellent            | 63 | Excellent            | 56 |
| 8                          | Excellent            | 70 | Excellent            | 63 |
| 11                         | Excellent            | 70 | Excellent            | 63 |
| 16                         | Excellent            | 63 | Excellent            | 56 |
| 22                         | Excellent            | 56 | Excellent            | 50 |
| 32                         | Excellent            | 50 | Excellent            | 45 |

#### CONTRAST

| CANON 135mm f/2<br>at 135mm<br>at 30 lines/mm |            |    |            |    |
|-----------------------------------------------|------------|----|------------|----|
| f/                                            | Center (%) |    | Corner (%) |    |
| 2                                             | High       | 55 | High       | 42 |
| 2.8                                           | High       | 62 | High       | 50 |
| 4                                             | High       | 63 | High       | 53 |
| 5.6                                           | High       | 67 | High       | 55 |
| 8                                             | High       | 69 | High       | 58 |
| 11                                            | High       | 60 | High       | 49 |
| 16                                            | High       | 50 | High       | 41 |
| 22                                            | High       | 47 | High       | 39 |
| 32                                            | High       | 41 | High       | 33 |

#### PERFORMANCE

| Our Standard                                                                                                     | as Tested                          |
|------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length:</b> ±5%<br>(66.50-73.50mm)<br>(199.50-220.50mm)                                                 | 72.29mm<br>206.19mm                |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 210mm: (f/3.33-3.68)                                                 | f/3.65<br>f/3.68                   |
| <b>Distortion:</b><br>70mm: (±2%)<br>210mm (±3.5%)                                                               | 0.43% (pincshn)<br>0.22% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.0 stops) | 0.4 stops<br>0.8 stops             |

#### MACRO RESOLUTION

| ANGENIEUX 70-210mm f/3.5<br>at 210mm<br>at 1:4 |                  |    |                  |    |
|------------------------------------------------|------------------|----|------------------|----|
| f/                                             | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                            | V. Good          | 36 | V. Good          | 29 |
| 5.6                                            | Excellent        | 40 | Excellent        | 32 |
| 8                                              | V. Good          | 45 | Good             | 32 |
| 11                                             | V. Good          | 40 | Good             | 32 |
| 16                                             | V. Good          | 40 | Good             | 32 |
| 22                                             | Good             | 36 | Accept           | 29 |

#### RESOLUTION

| ANGENIEUX 70-210mm f/3.5<br>at 70mm<br>at 1:49 |                  |    |                  |    |
|------------------------------------------------|------------------|----|------------------|----|
| f/                                             | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                            | V. Good          | 49 | Excellent        | 44 |
| 5.6                                            | V. Good          | 55 | Excellent        | 49 |
| 8                                              | V. Good          | 62 | Excellent        | 55 |
| 11                                             | Excellent        | 69 | Excellent        | 62 |
| 16                                             | Excellent        | 62 | Excellent        | 55 |
| 22                                             | V. Good          | 55 | Excellent        | 49 |

#### CONTRAST

| ANGENIEUX 70-210mm f/3.5<br>at 70mm<br>at 30 lines/mm |            |    |            |    |
|-------------------------------------------------------|------------|----|------------|----|
| f/                                                    | Center (%) |    | Corner (%) |    |
| 3.5                                                   | High       | 45 | High       | 34 |
| 5.6                                                   | High       | 61 | High       | 50 |
| 8                                                     | High       | 66 | High       | 56 |
| 11                                                    | High       | 62 | High       | 52 |
| 16                                                    | High       | 57 | High       | 47 |
| 22                                                    | High       | 41 | Medium     | 35 |



## CANON'S TWIN 300MM f/4 LENSES

**Specifications:** 300mm f/4 Canon telephoto FD, No. 26971. Accepts special rear mounted filters in snap-in holders, f/4 to f/32 plus "A" detents at half stops. Min. foc. dist.: 9 ft. (2.75m) 8 $\frac{3}{8}$  in. long 3 $\frac{1}{4}$  in. diameter (210 x 83mm) 2 lb. 6 oz. (1080g) \$513.00.

**Specifications:** 300mm f/4 Canon telephoto FD-L, No. 21258. Accepts special rear-mounted filters in snap-in holders. f/4 to f/32 plus "A" detents at half stops. Min. diameter (214 x 83) 2 lb. 8 oz. (1120g) \$1150.00.

**Practical comments:** These two 300mm f/4 telephoto by Canon may appear to be twins, but they are not. While similar in appearance, they are rather different in construction as the 300mm FD-L features low dispersion glass for improved color correction. Both lenses are moderately heavy, with the FD-L lens only about 2 Oz. more. These lenses have internal focusing which insures alignment of the big front elements. Rotation of almost a full turn brings the focus from infinity to the near point of about 9 ft. The aperture ring shows the lens opening with small, closely packed numbers. There is also an "A" mark for auto-diaphragm operation when the camera is used in the shutter-priority mode. Special filters in holders are inserted near the back of the lens. Finally, each lens has a removable tripod mounting ring which is adjustable for any camera body position, and a built-in lens hood.

The focusing scales have the usual marking in feet, in white, and meters in green lettering. The focus indicator has depth-of-field marks for lens apertures of f/8, f/11 and f/16. The smooth internal focusing is easy to operate, even with the eye at the viewer. The infinity focus mark is extended to show that infinity must be checked visually in the finder, due to the variation of the infinity setting with temperature.

**Field test slides:** Both lenses produced very sharp color transparencies for the central part of the format. Newr the edges and corners a noticeable amount of lateral color was detected in the transparencies taken with the FD lens. This was gone in the pictures taken with the FD-L lens. Wide open, the FD-L produced slightly more contrast and sharpness in the fine detail but at f/5.6 and beyond, there was little difference between the transparencies taken with either lens. In close-ups at about 10 ft., the pictures taken with the FD-L seemed a bit sharper and more contrasty at f/4. At smaller apertures, both lenses yielded images of above average quality.

**Optical bench analysis** (for optical experts only): The FD-L lens showed less spherical and much less axial color flare. The distance between the red and green focus in the FD-L is only .14mm, while it was almost .50mm for the FD. Off axis, near the format corners, there was some lateral color evident in the point image of the FD lens, while the FD-L showed much less. Both lenses showed a slight amount of coma at f/4, but this was nearly gone at f/8. No significant astigmatism or flare was seen in the point images from either lens. The major difference between the FD and FD-L lens is the much reduced color flare from the latter. (October 1985)

### PERFORMANCE 300mm f/4

| Our Standard                                                                      | as Tested       |
|-----------------------------------------------------------------------------------|-----------------|
| <b>Focal length:</b> $\pm 5\%$<br>(285.00-315.00mm)                               | 298.91mm        |
| <b>Aperture:</b> $\pm 5\%$<br>(f/3.80-4.20)                                       | f/4.01          |
| <b>Distortion:</b><br>( $\pm 3.5\%$ )                                             | 0.93% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.0 stops) | 0.5 stops       |

### RESOLUTION

| CANON 300mm f/4<br>at 1:50 |                      |    |                      |    |
|----------------------------|----------------------|----|----------------------|----|
| f/                         | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                          | Excellent            | 50 | Excellent            | 45 |
| 5.6                        | Excellent            | 50 | Excellent            | 45 |
| 8                          | Excellent            | 56 | Excellent            | 50 |
| 11                         | Excellent            | 63 | Excellent            | 56 |
| 16                         | Excellent            | 63 | Excellent            | 50 |
| 22                         | Excellent            | 56 | Excellent            | 45 |
| 32                         | Excellent            | 50 | Excellent            | 40 |

### CONTRAST

| CANON 300mm f/4<br>at 30 lines/mm |            |    |            |    |
|-----------------------------------|------------|----|------------|----|
| f/                                | Center (%) |    | Corner (%) |    |
| 4                                 | High       | 54 | High       | 50 |
| 5.6                               | High       | 61 | High       | 54 |
| 8                                 | High       | 68 | High       | 62 |
| 11                                | High       | 77 | High       | 70 |
| 16                                | High       | 66 | High       | 60 |
| 22                                | High       | 52 | High       | 50 |
| 32                                | High       | 43 | High       | 38 |

### PERFORMANCE 300mm f/4 L

| Our Standard                                                                      | as Tested       |
|-----------------------------------------------------------------------------------|-----------------|
| <b>Focal length:</b> $\pm 5\%$<br>(285.00-315.00mm)                               | 299.06mm        |
| <b>Aperture:</b> $\pm 5\%$<br>(f/3.80-4.20)                                       | f/4.10          |
| <b>Distortion:</b><br>( $\pm 3.5\%$ )                                             | 0.94% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.0 stops) | 0.3 stops       |

### RESOLUTION

| CANON 300mm f/4 L<br>at 1:50 |                      |    |                      |    |
|------------------------------|----------------------|----|----------------------|----|
| f/                           | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                            | Excellent            | 50 | Excellent            | 45 |
| 5.6                          | Excellent            | 56 | Excellent            | 50 |
| 8                            | Excellent            | 63 | Excellent            | 56 |
| 11                           | Excellent            | 70 | Excellent            | 63 |
| 16                           | Excellent            | 63 | Excellent            | 56 |
| 22                           | Excellent            | 56 | Excellent            | 50 |
| 32                           | Excellent            | 50 | Excellent            | 45 |

### CONTRAST

| CANON 300mm f/4 L<br>at 30 lines/mm |            |    |            |    |
|-------------------------------------|------------|----|------------|----|
| f/                                  | Center (%) |    | Corner (%) |    |
| 4                                   | High       | 57 | High       | 53 |
| 5.6                                 | High       | 65 | High       | 60 |
| 8                                   | High       | 74 | High       | 63 |
| 11                                  | High       | 80 | High       | 71 |
| 16                                  | High       | 68 | High       | 62 |
| 22                                  | High       | 61 | High       | 51 |
| 32                                  | High       | 50 | High       | 40 |

## CANON'S 35-105mm AF TELE ZOOM LENS

**Specifications:** 35-105mm f/3.5-4.5 autofocus Canon zoom, No.1006631 in Canon AF bayonet mount; accepts 58mm threaded accessories; f/3.5 (4.5) to f/22; settable to half-stop intervals with body controls, no aperture markings on lens; focus to four feet (1.2m); to 2 1/2 feet at full macro setting; 3 1/4 inches long, 2 7/8 inches diameter (77x73mm), 14 1/16 ounces. (399g). \$394.

**Practical comments:** Stubby, 3:1 push/pull zoom balances nicely on Canon EOS. Easy push-on inch-wide rubberized hand grip moves you rapidly to 105mm; no zoom creep in any position. In manual, 3/8 inch wide front-focusing ring moves easily without backlash but with some resistance from in-lens focusing motor. Well-located manual/autofocusing switch atop lens barrel. Green footage scale under window in lens barrel is hard to read in dim light; white metric and focal length scales are more easily legible. No depth-of-field scale. Depth-of-field preview button on camera body.

**Field test slides:** Our Kodachromes were generally crisp and snappy. At 35mm, wide open, corners were slightly soft; equaled central sharpness by f/5.6. Very slight barrel distortion noted. At the 50 and 105mm settings, corners and center were slightly soft wide open; overall sharpness was achieved by f/5.6. Very slight pincushion distortion noted at 105mm. Flare was well controlled throughout. Performance was slightly above average for a zoom of this type.

**Optical bench analysis:** At 35mm, on-axis, very slight undercorrected spherical aberration was noted. Very slight yellow flare disappeared one stop down. Diffraction limited by f/11. Off-axis, very slight astigmatism was mixed with very slight skew-ray flare; almost gone by f/11. Lateral color was present.

At 50mm, on-axis, very slight overcorrected spherical aberration with very slight yellow flare was seen; gone two stops down. Diffraction limited by f/11. Off-axis, very slight astigmatism was mixed with very slight skew-ray flare; almost gone by f/16.

At 105mm, very slight overcorrected spherical aberration with very slight yellow/red flare; gone by f/8. Diffraction limited by f/16. Off-axis, very slight astigmatism was mixed with high coma; almost gone by f/16. Some lateral color.

### PERFORMANCE

| Our Standard                                                                                                    | As Tested                       |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(33.25- 36.75mm)<br>(99.75-110.25mm)                                          | 35.23mm<br>103.86mm             |
| <b>Aperture:</b> $\pm 5\%$<br>(f/3.33-3.68)<br>at 105mm: (f/4.28-4.73)                                          | f/3.35<br>f/4.70                |
| <b>Distortion:</b><br>35mm: ( $\pm 2.5\%$ )<br>105mm: ( $\pm 2.5\%$ )                                           | .5% (barrel)<br>1.89% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>105mm: (0-1.1 stops) | 0.9 stops<br>0.6 stops          |



## RESOLUTION

CANON 35-105mm f/3.5-4.5  
at 35mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 3.5 | Excellent     | 50            |
| 4.5 | Excellent     | 56            |
| 5.6 | Excellent     | 63            |
| 8   | Excellent     | 63            |
| 11  | Excellent     | 56            |
| 16  | Excellent     | 56            |
| 22  | Excellent     | 50            |

at 50mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 3.5 | Excellent     | 50            |
| 4.5 | Excellent     | 56            |
| 5.6 | V. Good       | 56            |
| 8   | Excellent     | 63            |
| 11  | Excellent     | 56            |
| 16  | Excellent     | 56            |
| 22  | V. Good       | 50            |

at 105mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4.5 | Excellent     | 50            |
| 5.6 | Excellent     | 56            |
| 8   | Excellent     | 63            |
| 11  | Excellent     | 56            |
| 16  | Excellent     | 56            |
| 22  | V. Good       | 50            |

## CONTRAST

at 35mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 3.5 | High       | 52         |
| 4.5 | High       | 54         |
| 5.6 | High       | 58         |
| 8   | High       | 62         |
| 11  | High       | 55         |
| 16  | Medium     | 42         |
| 22  | Low        | 36         |

at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 3.5 | High       | 53         |
| 4.5 | High       | 55         |
| 5.6 | High       | 59         |
| 8   | High       | 61         |
| 11  | High       | 54         |
| 16  | Medium     | 43         |
| 22  | Low        | 37         |

at 105mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4.5 | High       | 57         |
| 5.6 | High       | 60         |
| 8   | High       | 61         |
| 11  | High       | 53         |
| 16  | High       | 42         |
| 22  | Medium     | 35         |

## CANON L 20-35mm WIDE-ANGLE ZOOM

**Specifications:** 20-35mm f/3.5 Canon L Zoom, no. 10319, in FD mount; accepts 72

mm filters; f/3.5 to f/22 plus "A," detents at 1/2 stop intervals; min. foc. dist.: 20 in. (.5 m); 3 3/4 in. long, 2 7/8 in. diameter (86 x 73 mm); 1 lb. (454g) \$1062.00.

**Practical comments:** Compact and lightweight; superbly finished and well-balanced on camera body. "Two-touch" controls: zoom ring travels 45° from 20 to 35mm, focus ring 90° from infinity to closest distance. Both have well-knurled, 1/8 in. rubberized surfaces. Zoom calibrated at 20, 24, 28 and 35mm focal lengths, corresponding to commonly available wide-angle lenses. Apertures, focal

## PERFORMANCE

| Our Standard                                                      | as Tested                            |
|-------------------------------------------------------------------|--------------------------------------|
| <b>Focal length:</b> ±5%<br>(19.00-21.00mm)<br>(33.25-36.75mm)    | 20.13mm<br>35.23mm                   |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 35mm: (f/3.33-3.68)   | f/3.54<br>f/3.65                     |
| <b>Distortion:</b><br>20mm: (±4%)<br>35mm: (±2.5%)                | 1.34% (barrel),<br>under 1% (barrel) |
| <b>Light fall-off:</b> at f/5.6<br>+1 stop from theoretical limit |                                      |
| 20mm: (0-3.0 stops)                                               | 1.5 stops                            |
| 35mm: (0-1.9 stops)                                               | 1.2 stops                            |

## RESOLUTION

| CANON L 20-35mm f/3.5<br>at 20mm<br>at 1: 49 |               |               |           |    |
|----------------------------------------------|---------------|---------------|-----------|----|
| f/                                           | Center (l/mm) | Corner (l/mm) |           |    |
| 3.5                                          | V. Good       | 49            | Excellent | 39 |
| 5.6                                          | V. Good       | 49            | Excellent | 44 |
| 8                                            | V. Good       | 55            | Excellent | 49 |
| 11                                           | Excellent     | 62            | Excellent | 49 |
| 16                                           | Excellent     | 62            | Excellent | 49 |
| 22                                           | Excellent     | 55            | Excellent | 44 |

## CONTRAST

| CANON L 20-35mm f/3.5<br>at 20mm<br>at 30 lines/mm |            |            |        |    |
|----------------------------------------------------|------------|------------|--------|----|
| f/                                                 | Center (%) | Corner (%) |        |    |
| 3.5                                                | High       | 50         | High   | 31 |
| 5.6                                                | High       | 52         | High   | 40 |
| 8                                                  | High       | 59         | High   | 41 |
| 11                                                 | High       | 63         | Medium | 35 |
| 16                                                 | High       | 57         | Medium | 34 |
| 22                                                 | High       | 45         | Medium | 30 |

lengths and distance in meters legibly marked in white; footage scale in green. "A" setting provides for shutter-preferred auto operation (camera sets aperture). Solid, well-constructed feel.

**Field test slides:** Slides were crisp and snappy at all focal lengths, with detail well rendered. At 20mm both center and corner sharpness improved by f/8 but were still above average wide open and at f/5.6. At 28mm and 35mm center and corner sharpness again improved at f/8. Fall-off could be seen in corners wide open at 20mm and 28mm but was completely gone by f/8. Flare well controlled throughout. Above average for wide-angle zoom of this range.

**Optical bench analysis** (for optical experts only): At 20mm, on axis, slight undercorrected spherical aberration, very slight red flare gone by f/5.6, diffraction limited pattern by f/8. Off axis, slight skew-ray flare mixed with astigmatism; lateral color throughout.

At 28mm, on axis, slight undercorrected

## Interchangeable Lenses

### RESOLUTION

| CANON L 20-35mm f/3.5<br>at 28mm<br>at 1: 49 |               |               |           |    |
|----------------------------------------------|---------------|---------------|-----------|----|
| f/                                           | Center (l/mm) | Corner (l/mm) |           |    |
| 3.5                                          | V. Good       | 49            | Excellent | 44 |
| 5.6                                          | V. Good       | 49            | Excellent | 44 |
| 8                                            | V. good       | 55            | Excellent | 49 |
| 11                                           | Excellent     | 62            | Excellent | 55 |
| 16                                           | Excellent     | 62            | Excellent | 49 |
| 22                                           | Excellent     | 55            | Excellent | 44 |

### CONTRAST

| CANON L 20-35mm f/3.5<br>at 28mm<br>at 30 lines/mm |            |            |        |    |
|----------------------------------------------------|------------|------------|--------|----|
| f/                                                 | Center (%) | Corner (%) |        |    |
| 3.5                                                | High       | 53         | High   | 34 |
| 5.6                                                | High       | 56         | High   | 39 |
| 8                                                  | High       | 60         | High   | 40 |
| 11                                                 | High       | 63         | Medium | 36 |
| 16                                                 | High       | 56         | Medium | 33 |
| 22                                                 | High       | 44         | Low    | 29 |

### RESOLUTION

| CANON L 20-35mm f/3.5<br>at 35mm<br>at 1: 49 |               |               |           |    |
|----------------------------------------------|---------------|---------------|-----------|----|
| f/                                           | Center (l/mm) | Corner (l/mm) |           |    |
| 3.5                                          | V. Good       | 49            | Excellent | 44 |
| 5.6                                          | V. Good       | 49            | Excellent | 44 |
| 8                                            | V. Good       | 55            | Excellent | 49 |
| 11                                           | Excellent     | 62            | Excellent | 55 |
| 16                                           | Excellent     | 62            | Excellent | 49 |
| 22                                           | Excellent     | 55            | Excellent | 44 |

### CONTRAST

| CANON L 20-35mm f/3.5<br>at 35mm<br>at 30 lines/mm |            |            |        |    |
|----------------------------------------------------|------------|------------|--------|----|
| f/                                                 | Center (%) | Corner (%) |        |    |
| 3.5                                                | High       | 51         | High   | 34 |
| 5.6                                                | High       | 53         | High   | 37 |
| 8                                                  | High       | 57         | High   | 40 |
| 11                                                 | High       | 60         | Medium | 34 |
| 16                                                 | High       | 56         | Medium | 30 |
| 22                                                 | High       | 48         | Low    | 29 |

spherical aberration again present, diffraction limited by f/8. Off axis, same as at 20mm. At 35mm, on-axis results same as at 20mm and 28mm. Off axis at 35mm, slight skew-ray flare mixed with slight coma; lateral color throughout. (January 1985)

## 70-210 f/4 CANON HAS MACRO FOCUSING

**Specifications:** 70-210mm f/4 Canon FD Zoom, No. 242462 in Canon mount, accepts 58mm bayonet accessories; f/4 to f/32 with half stop detents; min. foc. dist. 4 ft. (17 1/4 in. in macro) (1.2m and 0.44) max. mag. 1:4 in "macro" mode; 6 in. long, 2 3/4 in. diam. (152 x 70mm), 23 1/4 oz. (660g.) \$305.00.

**Practical comments:** This moderately priced Canon zoom features single touch (combined zoom and focusing) control via a rubberized studded 2 7/8 in. wide smoothly operating collar. Macro focusing is available only at the 70mm focal length. The 12 element 9 group lens makes ample use of plastic barrel parts in non-essential areas. The dull black satin finish has a very legible depth of field scale and large numerals throughout.



## Interchangeable Lenses

### RESOLUTION

| Canon 70-210mm f/4<br>at 70mm<br>at 1:49 |                  |    |                  |    |
|------------------------------------------|------------------|----|------------------|----|
| f/no.                                    | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4                                        | Good             | 44 | V. Good          | 31 |
| 5.6                                      | Good             | 49 | V. Good          | 35 |
| 8                                        | Good             | 55 | Excellent        | 44 |
| 11                                       | V. Good          | 55 | Excellent        | 49 |
| 16                                       | Good             | 49 | Excellent        | 49 |
| 22                                       | Good             | 49 | V. Good          | 39 |
| 32                                       | Good             | 39 | Excellent        | 35 |

### CONTRAST

| Canon 70-210mm f/4<br>at 70mm<br>at 30 lines/mm |            |    |            |    |
|-------------------------------------------------|------------|----|------------|----|
| f/no.                                           | Center (%) |    | Corner (%) |    |
| 4                                               | High       | 44 | High       | 44 |
| 5.6                                             | High       | 58 | High       | 46 |
| 8                                               | High       | 64 | High       | 57 |
| 11                                              | High       | 64 | High       | 59 |
| 16                                              | High       | 64 | High       | 55 |
| 22                                              | High       | 49 | High       | 46 |
| 32                                              | High       | 35 | High       | 40 |

### RESOLUTION

| Canon 70-210mm f/4<br>at 135mm<br>at 1:50 |                  |    |                  |    |
|-------------------------------------------|------------------|----|------------------|----|
| f/no.                                     | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4                                         | V. Good          | 45 | Excellent        | 35 |
| 5.6                                       | V. Good          | 50 | V. Good          | 35 |
| 8                                         | Good             | 50 | Excellent        | 40 |
| 11                                        | Excellent        | 56 | Excellent        | 45 |
| 16                                        | V. Good          | 50 | Excellent        | 45 |
| 22                                        | Good             | 45 | Excellent        | 40 |
| 32                                        | Good             | 40 | Excellent        | 35 |

### CONTRAST

| Canon 70-210mm f/4<br>at 135mm<br>at 30 lines/mm |            |    |            |    |
|--------------------------------------------------|------------|----|------------|----|
| f/no.                                            | Center (%) |    | Corner (%) |    |
| 4                                                | High       | 48 | High       | 36 |
| 5.6                                              | High       | 48 | High       | 38 |
| 8                                                | High       | 50 | High       | 44 |
| 11                                               | High       | 46 | High       | 40 |
| 16                                               | High       | 46 | High       | 38 |
| 22                                               | High       | 40 | Medium     | 35 |
| 32                                               | High       | 40 | High       | 35 |

### RESOLUTION

| Canon 70-210mm f/4<br>at 210mm<br>at 1:51 |                  |    |                  |    |
|-------------------------------------------|------------------|----|------------------|----|
| f/no.                                     | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4                                         | V. Good          | 36 | Excellent        | 32 |
| 5.6                                       | Excellent        | 40 | Excellent        | 32 |
| 8                                         | V. Good          | 45 | V. Good          | 36 |
| 11                                        | V. Good          | 40 | V. Good          | 36 |
| 16                                        | Excellent        | 45 | V. Good          | 36 |
| 22                                        | V. Good          | 40 | Good             | 32 |
| 32                                        | V. Good          | 36 | Good             | 29 |

### CONTRAST

| Canon 70-210mm f/4<br>at 210mm<br>at 30 lines/mm |            |    |            |    |
|--------------------------------------------------|------------|----|------------|----|
| f/no.                                            | Center (%) |    | Corner (%) |    |
| 4                                                | Medium     | 30 | Medium     | 24 |
| 5.6                                              | Medium     | 37 | Medium     | 22 |
| 8                                                | High       | 44 | Medium     | 32 |
| 11                                               | High       | 43 | Low        | 28 |
| 11                                               | High       | 43 | Low        | 28 |
| 16                                               | High       | 46 | Low        | 26 |
| 22                                               | High       | 42 | Medium     | 30 |
| 32                                               | High       | 42 | High       | 30 |

Zoom lengths are marked at the 70, 100, 135 and 210 positions. While the zoom collar operates with just a light touch; there was no slippage whether the lens was pointed upwards or downwards.

**Field test slides:** Crisp, clean details at all apertures although some improvement was seen between maximum and next aperture. Flare was well controlled. Pictures were of equal quality at all focal lengths. In macro position, the picture centers were quite good except at maximum aperture. Corner performance was not as good.

**Optical bench analysis:** (for optical experts only): At 70mm, on axis, very slight flare and aspherical aberration was present but gone by f/8. It was near the theoretical diffraction limit by f/11. Off axis, very slight coma was present to f/11. There was very slight lateral color. At 135mm, very slight lateral color. At 135mm, very slight flare could be seen along with very slight aspherical aberration which

### PERFORMANCE

| Our Standard                                                                                                     | as Tested                        |
|------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(66.50-73.50mm)<br>(199.50-220.50mm)                                           | 71.40mm<br>205.96mm              |
| <b>Aperture:</b> $\pm 5\%$<br>(f/3.80-4.20)<br>at 210mm: (f/3.80-4.20)                                           | f/4.19<br>f/4.20                 |
| <b>Distortion:</b><br>70mm: $(\pm 2\%)$<br>210mm: $(\pm 3.5\%)$                                                  | 1.35% (barrel)<br>1.87% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.03 stops) | 0.8 stops<br>1.0 stops           |

disappeared at f/11. Very slight axial color could be detected. Off axis, very slight astigmatism was present. At 210mm, on axis, slight primary photographic aberration was almost gone by f/11. Slight lateral color was also present. Off axis, slight lateral color disappeared by f/11. (August 1983)

## COMPACT, CANON FD 28s AND AN 80-200

**Specifications:** 28mm f/2.8 Canon FD in Canon FD breech lock mount; No. 10261; accepts 52mm filters; f/2.8 to f/22 with detents at  $\frac{1}{2}$ -stop intervals; min. foc. dist. 1 ft. (.3m); 1 $\frac{1}{2}$  in. long, 2 $\frac{3}{8}$  in. diam.; 6 oz.; \$162.00

**Specifications:** 28mm f/2 Canon FD in Canon FD breech lock mount; No. 30817; accepts 52mm filters; f/2 to f/22 with detents at  $\frac{1}{2}$ -stop intervals; Min. foc. dist. 1 ft. 3 in. (.4m); 2 in. long, 2 $\frac{3}{8}$  in. diam.; 9 $\frac{1}{2}$  oz.; \$504.00

**Specifications:** 80-200mm f/4 Canon FD in Canon FD breech lock mount; No. 70906; accepts 58mm filters; f/4 to f/32 with detents at  $\frac{1}{2}$ -stop intervals; min. foc. dist. 3.2 ft. (1m); 6 $\frac{3}{8}$  in. long, 2 $\frac{3}{8}$  in. diam.; 1 lb. 11 oz.; \$619.00

As Canon changes more and more lenses from its old-style breechlock external ring locking moon to the new FD style internal locking breech mechanism, it is streamlining and refining its lenses, both optically and mechanically.

These lenses share Canon's impeccable instrument black finish, rubberized focusing, diaphragm, and zoom (where appropriate) controls. Metric scales are engraved in white,

### PERFORMANCE

| Our Standard                                                                       | Tested        |
|------------------------------------------------------------------------------------|---------------|
| <b>Focal length:</b> $\pm 5\%$<br>(26.60-29.40)                                    | 28.99mm       |
| <b>Aperture:</b> $\pm 5\%$<br>(f/2.66-f/2.94)                                      | f/2.87        |
| <b>Distortion:</b> ( $\pm 2.5\%$ )                                                 | 1.3% (barrel) |
| <b>Light falloff:</b> at f/5.6,<br>+1 stop from theoretical limit<br>(0-1.9 stops) | 1.2 stops     |

### RESOLUTION

| Canon 28mm f/2.8<br>at 1:50 Magnification |                      |    |                      |    |
|-------------------------------------------|----------------------|----|----------------------|----|
| f/no.                                     | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 2.8                                       | V. Good              | 50 | Excellent            | 40 |
| 4.0                                       | Excellent            | 56 | Excellent            | 40 |
| 5.6                                       | V. Good              | 56 | Excellent            | 45 |
| 8                                         | V. Good              | 56 | Excellent            | 50 |
| 11                                        | V. Good              | 50 | Excellent            | 45 |
| 16                                        | V. Good              | 50 | V. Good              | 40 |
| 22                                        | Good                 | 45 | Accept               | 35 |

### CONTRAST

| Canon 28mm f/2.8<br>at 30 lines/mm |            |    |            |    |
|------------------------------------|------------|----|------------|----|
| f/no.                              | Center (%) |    | Corner (%) |    |
| 2.8                                | High       | 64 | Low        | 20 |
| 4.0                                | High       | 75 | Low        | 22 |
| 5.6                                | High       | 84 | Low        | 30 |
| 8                                  | High       | 79 | Low        | 28 |
| 11                                 | High       | 60 | Low        | 30 |
| 16                                 | High       | 47 | Low        | 26 |
| 22                                 | Medium     | 40 | Low        | 26 |

### PERFORMANCE

| Our Standard                                                                       | Tested       |
|------------------------------------------------------------------------------------|--------------|
| <b>Focal length:</b> $\pm 5\%$<br>(26.60-29.40)                                    | 28.68mm      |
| <b>Aperture:</b> $\pm 5\%$<br>(f/1.90-f/2.10)                                      | f/2.09       |
| <b>Distortion:</b> ( $\pm 2.5\%$ )                                                 | <1% (barrel) |
| <b>Light falloff:</b> at f/5.6,<br>+1 stop from theoretical limit<br>(0-1.9 stops) | 1.3 stops    |

### RESOLUTION

| Canon 28mm f/2<br>at 1:47 Magnification |                      |    |                      |    |
|-----------------------------------------|----------------------|----|----------------------|----|
| f/no.                                   | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 2.0                                     | Good                 | 47 | V. Good              | 33 |
| 2.8                                     | Excellent            | 59 | V. Good              | 33 |
| 4.0                                     | V. Good              | 59 | Good                 | 37 |
| 5.6                                     | Excellent            | 67 | V. Good              | 42 |
| 8                                       | V. Good              | 59 | V. Good              | 42 |
| 11                                      | V. Good              | 53 | V. Good              | 42 |
| 16                                      | Good                 | 47 | Good                 | 37 |
| 22                                      | Accept               | 42 | Good                 | 37 |

### CONTRAST

| Canon 28mm f/2<br>at 30 lines/mm |            |    |            |    |
|----------------------------------|------------|----|------------|----|
| f/no.                            | Center (%) |    | Corner (%) |    |
| 2.0                              | Medium     | 40 | Medium     | 30 |
| 2.8                              | High       | 58 | Medium     | 32 |
| 4.0                              | High       | 57 | High       | 44 |
| 5.6                              | Medium     | 55 | High       | 46 |
| 8                                | Medium     | 55 | High       | 47 |
| 11                               | High       | 56 | High       | 45 |
| 16                               | High       | 50 | High       | 42 |
| 22                               | Low        | 36 | Medium     | 38 |



footage scales in slightly harder to read green.

Apertures are all engraved in white with half-stop detents. The 28s carry red dot indexes for infrared use while the zoom carries a numbered infrared index for each focal length setting.

The 28mm f/2.8 7-element wide-angle focuses to 1 foot with a clockwise 135° turn of

## PERFORMANCE

| Our Standard                                                                                                     | Tested                             |
|------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length:</b> ±5%<br>(76.00–84.00)<br>(190.00–210.00)                                                     | 82.08mm<br>197.87mm                |
| <b>Aperture:</b> ±5%<br>(f/3.80–f/4.20)<br>at 200mm:                                                             | f/4.09<br>f/4.19                   |
| <b>Distortion:</b><br>80mm: (±2.0%)<br>200mm: (±2.5%)                                                            | 1.1% (barrel)<br>1.3% (pincushion) |
| <b>Light falloff:</b> at f/5.6,<br>+1 stop from theoretical limit<br>80mm: (0–1.1 stops)<br>200mm: (0–1.0 stops) | 0.8 stops<br>0.8 stops             |

## RESOLUTION

| Canon 80-200mm f/4<br>at 135mm:<br>at 1:50 Magnification |                      |                      |           |    |
|----------------------------------------------------------|----------------------|----------------------|-----------|----|
| f/no.                                                    | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 4.0                                                      | V. Good              | 45                   | Excellent | 32 |
| 5.6                                                      | V. Good              | 50                   | V. Good   | 35 |
| 8                                                        | V. Good              | 56                   | Excellent | 40 |
| 11                                                       | V. Good              | 50                   | Excellent | 40 |
| 16                                                       | V. Good              | 50                   | Excellent | 45 |
| 22                                                       | Good                 | 45                   | Excellent | 40 |
| 32                                                       | Good                 | 40                   | V. Good   | 32 |

## CONTRAST

| Canon 80-200mm f/4<br>at 135mm:<br>at 30 lines/mm |            |            |        |    |
|---------------------------------------------------|------------|------------|--------|----|
| f/no.                                             | Center (%) | Corner (%) |        |    |
| 4.0                                               | High       | 40         | Low    | 22 |
| 5.6                                               | High       | 46         | Medium | 30 |
| 8                                                 | High       | 50         | High   | 53 |
| 11                                                | High       | 50         | High   | 45 |
| 16                                                | High       | 44         | High   | 40 |
| 22                                                | High       | 42         | Medium | 35 |
| 32                                                | High       | 40         | High   | 33 |

## RESOLUTION

| Canon 80-200mm f/4<br>at 200mm:<br>at 1:50 Magnification |                      |                      |           |    |
|----------------------------------------------------------|----------------------|----------------------|-----------|----|
| f/no.                                                    | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 4.0                                                      | Excellent            | 40                   | Excellent | 32 |
| 5.6                                                      | Excellent            | 45                   | Excellent | 32 |
| 8                                                        | Excellent            | 50                   | Good      | 35 |
| 11                                                       | Excellent            | 45                   | Good      | 35 |
| 16                                                       | Excellent            | 45                   | Good      | 35 |
| 22                                                       | V. Good              | 40                   | Good      | 32 |
| 32                                                       | V. Good              | 35                   | Good      | 28 |

## CONTRAST

| Canon 80-200mm f/4<br>at 200mm:<br>at 30 lines/mm |            |            |        |    |
|---------------------------------------------------|------------|------------|--------|----|
| f/no.                                             | Center (%) | Corner (%) |        |    |
| 4.0                                               | High       | 56         | High   | 34 |
| 5.6                                               | High       | 55         | High   | 35 |
| 8                                                 | High       | 64         | Medium | 34 |
| 11                                                | High       | 64         | Medium | 32 |
| 16                                                | High       | 59         | Low    | 28 |
| 22                                                | High       | 48         | Low    | 28 |
| 32                                                | High       | 54         | High   | 40 |

## RESOLUTION

| Canon 80-200mm f/4<br>at 80mm:<br>at 1:49 Magnification |                      |                      |           |    |
|---------------------------------------------------------|----------------------|----------------------|-----------|----|
| f/no.                                                   | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 4.0                                                     | Good                 | 44                   | V. Good   | 31 |
| 5.6                                                     | Good                 | 49                   | Excellent | 39 |
| 8                                                       | Good                 | 55                   | Excellent | 44 |
| 11                                                      | V. Good              | 55                   | Excellent | 49 |
| 16                                                      | V. Good              | 55                   | Excellent | 49 |
| 22                                                      | Good                 | 49                   | V. Good   | 39 |
| 32                                                      | Good                 | 39                   | V. Good   | 31 |

## CONTRAST

| Canon 80-200mm f/4<br>at 80mm:<br>at 30 lines/mm |            |            |        |    |
|--------------------------------------------------|------------|------------|--------|----|
| f/no.                                            | Center (%) | Corner (%) |        |    |
| 4.0                                              | High       | 43         | Low    | 22 |
| 5.6                                              | High       | 50         | Medium | 26 |
| 8                                                | High       | 52         | Medium | 36 |
| 11                                               | High       | 52         | High   | 39 |
| 16                                               | High       | 48         | High   | 38 |
| 22                                               | High       | 40         | High   | 37 |
| 32                                               | High       | 40         | High   | 37 |

its 12mm wide textured rubber focusing grip. Internal changes have shortened its overall length nearly ¾ of an inch.

The new 28mm f/2 packs 10 elements in 9 groups (including a floating element) into a mount nearly half an inch shorter than its predecessor. The focusing ring is a full 20mm wide and focuses to 1¼ ft. with a clockwise 135° turn.

The fast 80-200 f/4 twin-ring zoom packs 15 elements in 11 groups into its 6¾ in. length. A 350° clockwise twist of its generous 30mm wide square textured focusing ring moves the lens to its 3.2 ft. near focus. A separate linear textured zoom ring takes you from 80 to 200mm with a smooth 105° counterclockwise turn. Smallest area covered (at 200mm and 1 meter is 3 by 4½ in.), more than sufficient for most close-up work. Well-designed, smooth operating twin-rings set easily and positively, allow independent zooms without shifting focus whether shooting level, up, or straight down. Construction seemed solid and precise. There's no tripod socket, but the lens is quite compact and well-balanced.

**Field test slides:** The 28mm f/2.8 Canon produced Kodachrome transparencies that were sharp and contrasty throughout its aperture range, an above-average performance for a wide angle even of this speed. Under high magnification, some slight color fringing was noticeable in the corners but was judged of minor import.

The fast 28mm f/2 again produced sharp and contrasty transparencies throughout its aperture range, though the middle apertures were noticeably sharper. Flare was well-controlled, a plus for a fast wide angle. Color fringing in corners was barely noticeable.

The 80-200mm f/4 zoom produced slightly soft test slides at 200mm and f/4. Results were greatly improved stopping down to f/8. Flare was well-controlled throughout the zoom and aperture range. Close-up performance was good especially at middle apertures.

**Optical bench report** (for optical experts only): The 28mm f/2.8 showed very slight spherical aberration on axis wide open. By f/4 it was near diffraction limits in performance. Off axis we saw slight skew ray flare

## Interchangeable Lenses

and astigmatism until f/5.6. Slight lateral color was present.

The 28mm f/2 showed slight red flare and very slight spherical aberration on axis until f/4. It was near diffraction limits by f/5.6. Off axis, we saw slight skew ray flare, which disappeared by f/5.6. Slight lateral color was present throughout the lens's aperture range.

The 80-200mm f/4 zoom, at 80mm, (on axis) showed slight spherical aberrations until f/8. By f/11 it was near diffraction limits. Off axis, it showed slight astigmatism until f/11. Slight lateral color was seen.

At 135mm, on-axis performance was the same as at 80mm. Off axis we saw very slight coma until f/11. Slight lateral color was present.

At 200mm, we saw slight spherical aberration until f/11. Diffraction limits were reached by f/16. Off-axis performance tests saw slight coma disappear at f/11. Again, slight lateral color was present. (July 1983)

## CANON TELE ZOOM WITH 3:1 ZOOM RATIO

**Specifications:** 100-300mm f/5.6 Canon Zoom FD; no. 157499 in Canon bayonet mount; accepts 58mm screw-in accessories; also bayonet lenshood; f/5.6 to f/32 and locking A setting with half stops detents; min. foc. dist. 7ft. (2m); 8½ in. long, 2¾ in. diam. (207 × 70mm). 29 ⅞ oz. (831g) \$310.00

**Practical comments:** single touch (combined zoom and focusing ring) rubberized 3¾ in. wide control, 100, 135, 200 and 300mm markings, depth-of-field scale, smooth zoom with no slippage when pointed up or down, clockwise focusing, large visible numerals, principally for hand-holding since lack of tripod socket makes a long lens unsteady with camera mounted on tripod.

**Field test slides:** Crisp, snappy with details well rendered. Some color fringing noticeable in corners. Slide sharpness dropped slightly at full aperture at all focal lengths but improved one stop smaller. Flare well controlled throughout. Above average performance for a zoom lens of this type.

**Optical bench analysis** (for optical experts only): At 100mm, on axis, slight secondary color aberration was noticeable but lens was diffraction limited by f/16. Off axis, there was slight coma mixed with very slight skew ray flare. Lateral color was present throughout.

At 200mm on axis, slight secondary color aberration continued mixed with very slight yellow flare, gone by f/16 at the diffraction limit. Off axis there was slight coma with slight skew ray flare and lateral color throughout.

## PERFORMANCE

| Our Standard                                                                                                     | as Tested                             |
|------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <b>Focal Length:</b> ±5%<br>(95.00–105.00mm)<br>(285.00–315.00mm)                                                | 103.70mm<br>301.05mm                  |
| <b>Aperture:</b> ±5%<br>(f/5.32–5.88)<br>at 300mm: (f/5.32–5.88)                                                 | f/5.69<br>f/5.87                      |
| <b>Distortion:</b><br>100mm: (±2%)<br>300mm: (±3.5%)                                                             | under 1% (barrel)<br>1.14% (pincushn) |
| <b>Light falloff:</b> at f/8.0<br>+1 stop from theoretical limit<br>100mm: (0–1.1 stops)<br>300mm: (0–1.0 stops) | 0.1 stops<br>0.6 stops                |



## Interchangeable Lenses

### RESOLUTION

| CANON 100-300mm f/5.6<br>at 100mm<br>at 1:49 |                  |    |                  |    |
|----------------------------------------------|------------------|----|------------------|----|
| f/                                           | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 5.6                                          | V. Good          | 49 | Excellent        | 44 |
| 8                                            | V. Good          | 55 | Excellent        | 49 |
| 11                                           | Excellent        | 62 | Excellent        | 49 |
| 16                                           | Excellent        | 62 | Excellent        | 49 |
| 22                                           | V. Good          | 55 | Excellent        | 44 |
| 32                                           | Excellent        | 49 | Excellent        | 39 |

### CONTRAST

| CANON 100-300mm f/5.6<br>at 100mm<br>at 30 lines/mm |               |    |               |    |
|-----------------------------------------------------|---------------|----|---------------|----|
| f/                                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 5.6                                                 | High          | 62 | High          | 45 |
| 8                                                   | High          | 70 | High          | 47 |
| 11                                                  | High          | 63 | High          | 46 |
| 16                                                  | High          | 61 | High          | 42 |
| 22                                                  | High          | 60 | High          | 40 |
| 32                                                  | High          | 44 | High          | 30 |

### RESOLUTION

| CANON 100-300mm f/5.6<br>at 200mm<br>at 1:49 |                  |    |                  |    |
|----------------------------------------------|------------------|----|------------------|----|
| f/                                           | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 5.6                                          | Excellent        | 49 | Excellent        | 44 |
| 8                                            | Excellent        | 49 | Excellent        | 44 |
| 11                                           | Excellent        | 55 | Excellent        | 49 |
| 16                                           | Excellent        | 55 | Excellent        | 49 |
| 22                                           | Excellent        | 49 | Excellent        | 44 |
| 32                                           | Excellent        | 44 | Excellent        | 39 |

### CONTRAST

| CANON 100-300mm f/5.6<br>at 200mm<br>at 30 lines/mm |               |    |               |    |
|-----------------------------------------------------|---------------|----|---------------|----|
| f/                                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 5.6                                                 | High          | 63 | High          | 46 |
| 8                                                   | High          | 69 | High          | 49 |
| 11                                                  | High          | 67 | High          | 46 |
| 16                                                  | High          | 62 | High          | 40 |
| 22                                                  | High          | 60 | High          | 39 |
| 32                                                  | High          | 45 | High          | 30 |

### RESOLUTION

| CANON 100-300mm f/5.6<br>at 300mm<br>at 1:49 |                  |    |                  |    |
|----------------------------------------------|------------------|----|------------------|----|
| f/                                           | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 5.6                                          | Excellent        | 44 | Excellent        | 39 |
| 8                                            | Excellent        | 49 | Excellent        | 44 |
| 11                                           | Excellent        | 55 | Excellent        | 44 |
| 16                                           | Excellent        | 49 | Excellent        | 44 |
| 22                                           | Excellent        | 49 | V. Good          | 39 |
| 32                                           | Excellent        | 44 | Excellent        | 39 |

### CONTRAST

| CANON 100-300mm f/5.6<br>at 300mm<br>at 30 lines/mm |               |    |               |    |
|-----------------------------------------------------|---------------|----|---------------|----|
| f/                                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 5.6                                                 | High          | 62 | High          | 45 |
| 8                                                   | High          | 68 | High          | 47 |
| 11                                                  | High          | 65 | High          | 45 |
| 16                                                  | High          | 61 | High          | 40 |
| 22                                                  | High          | 59 | High          | 37 |
| 32                                                  | High          | 43 | High          | 30 |

At 300mm on axis, slight secondary color aberration could still be detected mixed with very slight yellow flare. Again diffraction limited by f/16. Off axis, there was slight coma again with very slight astigmatism. Lateral color throughout. (March 1985)

## NORMAL, MACRO & SEMI-FISHEYE FROM FUJI

**Lens:** 16mm f/2.8 X-Fujinon Fisheye

**Mounts:** For Fujica X-series SLRs

**Filter size:** see Features

**Min. foc. dist.:** 8 in. (0.2m)

**Apertures:** f/2.8 to f/16

**Features:** Built-in filters include Skylight (SC40M), Yellow (SC48) Orange (SC56), and Light Balancing (LBB-4)

**Size:** 3 in. diam. × 2¼ in. long (74 × 56mm)

**Weight:** 14.4 oz. (408g)

**Price:** \$650.00

**Lens:** 55mm f/3.5 X-Fujinon-Macro

**Mounts:** For Fujica X-series SLRs

**Filter size:** 49mm screw-in

**Min. foc. dist.:** 9½ in. (0.241m)

**Apertures:** f/3.5 to f/22

**Features:** Magnification scale on barrel covers 1/25X to 1/2X range

**Size:** 5½ in. diam. × 2½ in. long (62 × 54mm)

**Weight:** 14¾ oz. (408g)

**Price:** \$260.00

**Lens:** 50mm f/1.6 X-Fujinon

**Mounts:** For Fujica X-series SLRs

**Filter size:** 49mm screw-in

**Min. foc. dist.:** 2 ft. (0.6m)

**Apertures:** f/1.6 to f/22

**Features:** No special features

**Size:** 2½ in. diam. × 1½ in. long (61.5 × 36.5mm)

**Weight:** 6.1 oz. (175g)

**Price:** \$94.00

Although each member of this optical trio is really a bird of a different feather, all three share the common trait of extending the picture-taking versatility of the current range of Fujica SLRs. In addition, all are finished in Fuji's standard matte black, have very legible white-on-black metric distance scales, less legible green-on-black footage scales, heavily knurled aperture rings at the rear, textured rubber focusing rings toward the front, and a second smaller aperture scale (at the very rear of the aperture ring) to provide apertures in the finder of the Fujica AX-3, which has an aperture-readout prism in the overhanging portion of the pentaprism housing. Other common features include an orange delta position after the f/16 setting on the aperture ring (it locks in with a spring-loaded button) for use with shutter-preferred automation, legible black-on-white depth-of-field scales with infrared focusing indices in red, and red orientation dots on the nicely chromed, three-lug bayonet mounts. All the lenses mount swiftly and firmly in place with a short clockwise twist, and are held securely in place by a large spring-loaded finger which mates with a detent on the top flange of the camera mount.

The widest member of the trio by far is the 16mm f/2.8 X-Fujinon, which covers 180° diagonally. In other words, it's a "semi-

fish-eye" which covers the entire 24 × 36mm format, with increasing barrel distortion as you approach the format edges. Its general size and image quality characteristics closely parallel those of the 16mm f/2.8 OK-Rokkor, the first lens of this speed and focal length introduced nearly a decade ago. Most photographers find these lenses more suitable for a wider range of photographic use than the true fisheye lenses, which provide a circular image in the center of the 35mm frame by virtue of their 180° lateral angular coverage. However, Fuji's 16 must still be regarded as a special effects optic since its extreme wide angle and depth of field and non-uniform linear distortion is most often used to create startling visual impressions.

Despite its chunky dimensions and fairly hefty weight, Fuji's 16 balances very well on current Fujica SLRs and focuses with reasonable precision using the central split-image rangefinder and/or microprism collar. The viewing image is remarkably uniform in brightness also, with nary a trace of falloff noticeable in the corners and at the edges. The 5/16 in. (8mm) wide textured focusing collar takes the lens down to minimum distance in a very smooth turn of about 130°, the apertures are click-stopped at whole stop intervals, and, as with most lenses of this type the "cookie cutter" front flange is only partially successful in protecting the huge (2½ in.) diameter front element from stray fingers, etc. A lightly knurled narrow f ring just in front of the focusing collar is for selecting one of the built-in filters opposite a white index line—one of the four must always be selected; there's no "filter out" position. One might quibble over Fuji's choice of filters since it's more difficult to mount one over the front of this lens, but most photographers will be pleased to have them built in. With its very good performance (see charts) and fast aperture, the 16mm X-Fujinon gives Fujica

### PERFORMANCE

| Our Standard                                                                        | Tested     |
|-------------------------------------------------------------------------------------|------------|
| <b>Focal Length:</b> ±5%<br>(15.2 to 16.8mm)                                        | 16.15mm    |
| <b>Max. aperture:</b> ±5%<br>(f/2.66 to f/2.94)                                     | f/2.72     |
| <b>Distortion:</b><br>not applicable for fisheye lens                               |            |
| <b>Light falloff:</b> at f/5.6,<br>+1 stop from theoretical limit<br>(0-3.99 stops) | 2.75 stops |

### RESOLUTION

| X-Fujinon Fisheye 16mm f/2.8<br>at 1:45 magnification |                    |                    |                                 |
|-------------------------------------------------------|--------------------|--------------------|---------------------------------|
| f/no.                                                 | Center<br>Lines/mm | Corner<br>Lines/mm |                                 |
| 2.8                                                   | Excellent          | 72                 | Not applicable to fisheye types |
| 4                                                     | Excellent          | 72                 |                                 |
| 5.6                                                   | Excellent          | 72                 |                                 |
| 8                                                     | Excellent          | 80                 |                                 |
| 11                                                    | Excellent          | 80                 |                                 |
| 16                                                    | Excellent          | 63                 |                                 |

### CONTRAST

| X-Fujinon Fisheye 16mm f/2.8<br>at 30 lines/mm |         |         |        |
|------------------------------------------------|---------|---------|--------|
| f/no.                                          | Center% | Corner% |        |
| 2.8                                            | High    | 50      | Low    |
| 4                                              | High    | 68      | Low    |
| 5.6                                            | High    | 79      | Low    |
| 8                                              | High    | 75      | Medium |
| 11                                             | High    | 68      | Medium |
| 16                                             | High    | 62      | Medium |



owners a semi-fisheye lens equal to or better than most of the competition.

Turning to the 55mm f/3.5 X-Fujinon Macro, we have another lens of conventional design but very good performance designed to compete with the best competitive normal macros on an equal footing. This nicely finished 5-element, 4-group optic is very light in weight, and its front element is deeply recessed so a separate sunshade should not be required. The 1/2 in.-wide (12mm) textured focusing collar takes the lens down to half-lifesize in a very smooth turn of approximately 270°, and there's a separate yellow-on-black magnification scale in front of the white-on-black metric scale and the less legible green-on-black footage scale. The secondary aperture scale, mounting procedure, lens-locking finger, and AE lock on the aperture ring parallel those features on the 16mm f/2.8 or, for that matter, on the 50mm f/1.6. As expected, the viewing image provided by this modest aperture lens is somewhat dimmer than those offered by faster optics, but viewing contrast is very good and the lens snaps into focus with alacrity, especially when using the central focusing aids. An automatic extension ring is available from Fuji that will

take this lens down to 1:1, and once again, Fujica owners have been served up with a lens that is the equal to virtually anything available in competitive SLR systems.

The first question most photographers ask when confronted with Fuji's nicely crafted 6-element, 6-group f/1.6 normal lens is, "Why an f/1.6?" The answer is that it provides a slightly faster normal lens alternative with a smidgen brighter viewing at virtually the same price as competitors' f/1.8's or f/2's, it's offered as a normal lens on Fujica SLRs to photographers away from rival machines fitted with 50mm f/1.7s, and the odd aperture generally makes people sit up and take notice.

Well they might, for this lens is reasonably compact and quite light, provides a very bright, contrasty viewing image, focuses very smoothly to its minimum distance in an approximately 150° turn of its 1/2 in. (6mm) -wide textured focusing collar, and (as you can see from the accompanying charts) performs very well indeed. This 50 follows the Fuji family heritage with large, legible white on black numerals (save for the aforementioned green-on-black footage scale) and its mounting procedure and control array closely parallel those of the other two lenses already covered. We were pleased to see that this relatively fast lens still accepts the same 49mm filters as most of the slower and smaller Fujinons, but we were less pleased that the aperture ring (which is click-stopped at whole stop intervals) has no setting in between f/1.6 and f/2.8. Still, this is a minor point in view of the lens's very good overall performance and moderate price.

**Optical bench analysis:** At f/2.8 in the cen-

ter of the field, the 16mm f/2.8 Fisheye yielded a bright, compact image indicative of very good optical correction. Although we observed slight flare wide open, attributable to under-corrected spherical aberration, the central image was excellent by f/5.6, with no color defects observable.

Toward the corners of the image field (80° off axis) we observed a moderate amount of lateral color (.04mm), but no flare or coma. Edge image quality was good, but limited by lateral color at all apertures.

The 55mm f/3.5 Fujinon Macro exhibited slight flare due to over-corrected spherical aberration at f/3.5 in the center of the field, but no color defects were observed at infinity. By f/5.6 central image quality was excellent. Toward the edges of the field (21° off axis) we noted slight flare but no astigmatism or lateral color wide open, and image quality was excellent at f/6.3.

In the macro range (1:3) we observed slight red flare wide open in the center of the field, but central image quality was excellent by f/5.6. Off axis in the macro range we noted slight coma at the widest apertures, and image quality was judged to be excellent by f/8. Overall, we judge this lens to provide well above average bench performance for a lens of this type.

Turning to the 50mm f/1.6 Fujinon, in the center of the field at maximum aperture, we observed moderate under-corrected spherical flare, but this was gone by f/2.8 and central image quality was excellent at f/4 and smaller apertures. Toward the edges and corners of the field (23° off axis), we noted slight skew-ray flare at f/1.6, as well as slight coma (but no astigmatism) at the two widest apertures. However, off-axis image quality improved to very good at f/5.6 and held at smaller apertures.

**Field test slides:** Transparencies shot with the 16mm f/2.8 showed the expected barrel distortion, which increased toward the edges of the field. Images in the center of the frame were slightly soft at f/2.8, but improved noticeably on stopping down, with very high sharpness and good contrast at f/4 on down. Toward the edges and corners of the frame, on-film images exhibit good detail, but slightly lower contrast at all apertures. Flare was very well controlled throughout.

The 55mm f/3.5 Fujinon Macro delivered images with good detail and contrast in the center of the frame at f/3.5, but quality improves noticeably at f/5.6 and holds smaller apertures. In the corners of the frame, the images exhibited very good sharpness and detail even at f/3.5—a fine performance—but there was a slight loss of sharpness at smaller apertures.

In the macro range, both central and corner images were contrasty and sharp with good detail at the widest apertures, but a slight loss of sharpness was visible on stopping down to f/8 and smaller stops. Flare was very well controlled throughout.

Turning to the 50mm f/1.6 Fujinon, we found on-film images in the center of the frame to be very sharp and detailed even wide open, with slight improvement on stopping down. Corner and edge performance showed a similar pattern, with only a slight improvement at smaller apertures, but good performance at all stops. Flare was very well controlled even in pictures shot at adverse shooting angles. Overall, we judge the f/1.6 to be an above average performer for a fast normal lens. (Feb. 1982)

## PERFORMANCE

| Our Standard                                                                        | Tested                |
|-------------------------------------------------------------------------------------|-----------------------|
| <b>Focal Length:</b> ±5%<br>(52.2 to 57.8mm)                                        | 55.38mm               |
| <b>Max. aperture:</b> ±5%<br>(f/3.3 to f/3.68)                                      | f/3.55                |
| <b>Distortion:</b><br>±1.5%                                                         | less than 1% (barrel) |
| <b>Light falloff:</b> at f/5.6,<br>+1 stop from theoretical limit<br>(0-1.41 stops) | 0.60 stops            |

## RESOLUTION

| X-Fujinon Macro 55mm f/3.5<br>at 1:52 magnification |                    |                    |           |    |
|-----------------------------------------------------|--------------------|--------------------|-----------|----|
| f/no.                                               | Center<br>Lines/mm | Corner<br>Lines/mm |           |    |
| 3.5                                                 | Excellent          | 58                 | Excellent | 58 |
| 5.6                                                 | Excellent          | 73                 | Excellent | 66 |
| 8                                                   | Excellent          | 73                 | Excellent | 66 |
| 11                                                  | Excellent          | 66                 | Excellent | 66 |
| 16                                                  | V. Good            | 58                 | Excellent | 58 |
| 22                                                  | V. Good            | 58                 | Excellent | 52 |

## CONTRAST

| X-Fujinon Macro 55mm f/3.5<br>at 30 lines/mm |          |          |      |    |
|----------------------------------------------|----------|----------|------|----|
| f/no.                                        | Center % | Corner % |      |    |
| 3.5                                          | High     | 60       | High | 60 |
| 5.6                                          | High     | 64       | High | 68 |
| 8                                            | High     | 70       | High | 70 |
| 11                                           | High     | 64       | High | 62 |
| 16                                           | High     | 57       | High | 52 |
| 22                                           | High     | 50       | High | 45 |

## RESOLUTION

| X-Fujinon Macro 55mm f/3.5<br>at 1:2 magnification |                    |                    |           |    |
|----------------------------------------------------|--------------------|--------------------|-----------|----|
| f/no.                                              | Center<br>Lines/mm | Corner<br>Lines/mm |           |    |
| 3.5                                                | Excellent          | 57                 | Excellent | 45 |
| 5.6                                                | Excellent          | 64                 | Excellent | 51 |
| 8                                                  | Excellent          | 72                 | V. Good   | 51 |
| 11                                                 | Excellent          | 72                 | Excellent | 64 |
| 16                                                 | V. Good            | 57                 | Excellent | 51 |
| 22                                                 | V. Good            | 51                 | V. Good   | 45 |

## PERFORMANCE

| Our Standard                                                                        | Tested        |
|-------------------------------------------------------------------------------------|---------------|
| <b>Focal Length:</b> ±5%<br>(47.5 to 52.5mm)                                        | 51.87mm       |
| <b>Max. aperture:</b> ±5%<br>(f/1.52 to f/1.68)                                     | f/1.65        |
| <b>Distortion:</b><br>±1.5%                                                         | 1.4% (barrel) |
| <b>Light falloff:</b> at f/5.6,<br>+1 stop from theoretical limit<br>(0-1.49 stops) | 0.20 stops    |

## RESOLUTION

| X-Fujinon 50mm f/1.6<br>at 1:52 magnification |                    |                    |           |    |
|-----------------------------------------------|--------------------|--------------------|-----------|----|
| f/no.                                         | Center<br>Lines/mm | Corner<br>Lines/mm |           |    |
| 1.6                                           | Excellent          | 73                 | Excellent | 52 |
| 2.8                                           | Excellent          | 83                 | Excellent | 58 |
| 4                                             | Excellent          | 83                 | Excellent | 58 |
| 5.6                                           | V. Good            | 56                 | Excellent | 58 |
| 8                                             | V. Good            | 66                 | Excellent | 58 |
| 11                                            | Excellent          | 66                 | Excellent | 66 |
| 16                                            | V. Good            | 68                 | Excellent | 58 |

## CONTRAST

| X-Fujinon 50 mm f/1.6<br>at 30 lines/mm |          |          |        |    |
|-----------------------------------------|----------|----------|--------|----|
| f/no.                                   | Center % | Corner % |        |    |
| 1.6                                     | Medium   | 42       | Medium | 28 |
| 2.8                                     | High     | 57       | Medium | 30 |
| 4                                       | High     | 72       | Medium | 40 |
| 5.6                                     | High     | 65       | High   | 52 |
| 8                                       | High     | 63       | High   | 54 |
| 11                                      | High     | 63       | High   | 54 |
| 16                                      | High     | 57       | High   | 50 |



## LONG TELE FROM FUJI

**Lens:** EBC X-Fujinon T 400mm f/4.5

**Serial no.:** 896006

**Mounts:** For Fujica cameras (see text)

**Filter size:** 48mm screw-in

**Apertures:** f/4.5 to f/45, clicks at half stops

**Min foc. dist.:** 24 ft. (7.38 m)

**Features:** Built-in sunshade; rotating tripod mount; separate rotating camera mount ring; manual diaphragm settings

**Size:** 12 in. long × 3.9 in. diam. (304 × 99 mm)

**Weight:** 4.1 lb. (1.8 kg)

**Price:** \$1050.00 with carrying case.

This lens rounds out the Fuji line of optics for their Fujica 35mm SLR cameras. In the parlance of poker players, this lens is a hidden ace. Moderately large and heavy, it has the speed for top-notch sports photography with today's faster color films. Optically, it is a surprise. Although the lens is marked as an "EBCX-Fujinon T" telephoto, it is actually nearly apochromatic. That is, it has superior color correction when compared to regular 400mm lenses. It is only about 12 in. long, which means that it is a true telephoto lens: shorter from front to film plane than its marked focal length. As a six-element design, it focuses by moving the entire optical barrel forward, without internal shifting of elements. It is, in fact, a rather old-fashioned lens without an automatic diaphragm.

The manually operated diaphragm itself is marked from f/4.5 to f/45, one stop further

than most of the 400mm teles available today. The lens focuses in to about 24 ft., and the minimum subject area is about 19 by 26 in. The tripod pad is attached to the lens barrel with a heavy ring and clamp. The entire lens barrel can be turned as desired. However, there is another adjustment for the camera body at the very rear of the lens. This ring has a pushbutton release, and the camera body can be oriented in any of four positions about 90° apart. Thus, the camera and lens user can select the position of the lens and the camera body independently. The rear-most part of the lens barrel is completely removable for installing screw-in Fujinon filters. Fuji may have in mind to make the lens to fit several other cameras by simply changing this rear tube.

The focusing scale is calibrated in feet (green numbers) and meters (white numbers). With a built-in sunshade, which is only 2.8 in. long, this lens can be used with any of the Fuji SLRs for sports, nature and other long-range picture taking under less than ideal lighting conditions, or for higher shutter speeds which are often needed.

**Optical bench analysis:** The point image at the center of the film format (on the optical axis) is very compact with no red or green flare. There is a slight amount of spherical aberration at f/4.5 resulting in a barely noticed flare, but it is gone at f/5.6. The image begins to show the diffraction rings at f/8, indicating that the image quality is just about at the theoretical best it can be for that aperture. Off axis, away from the center of the format and near the corner, the image is still quite sharp and compact with a slight amount of coma flare, which is gone at f/8. Overall, the image quality is very high and the field test pictures should be superior.

**Field test slides:** The central area details in the field test color slide images showed no color flare of any kind, and the sharpness was very high. Near the corner of the format, the images were still very sharp with only a slight softness with the lens at f/4.5. At smaller openings, the image sharpness and fine detail contrast were high. Small dark areas revealed no excess coloration, except for a slight blue haze due to atmospheric scattering. Close in, at 25 ft., the images sharpness remained high, but a slight increase in softness was noticed. But at f/5.6, the images were just about as sharp as those shot at long distances. Overall, this lens provides better than average performance for an optic of its speed and focal length. (March 1982)

## 105mm f/2.8 KIRON GETS DOWN TO 1:1

**Specifications:** 105mm f/2.8 Kiron Macro MC, No. 40701340; mounts for Canon, Nikon AI-S, Pentax K, Minolta, Olympus, Konica, Yashica/Contax; accepts 52mm filters; f/2.8-32 with click-stops at half-stop intervals to f/22; min foc dist. 17 in. (0.45m); max. magnification. 1:1; 4-in. long, 2 7/8-in. diam. (102.5x72mm); 1 lb., 6 3/4 oz. (650g); built-in sun shade; \$399.00.

**Practical comments:** Moderately long, rather wide barrel required to get this fast, medium-tele macro down to 1:1 in smooth, clockwise, 630° turn of 1 1/2-in. wide textured area of focusing collar; 6-element, 6-group lens is reasonably light for its f/2.8 aperture and

## PERFORMANCE

| Our Standard                                                                             | as Tested        |
|------------------------------------------------------------------------------------------|------------------|
| <b>Focal length:</b> ±5%<br>(99.75-110.25mm)                                             | 105.23mm         |
| <b>Aperture:</b> ±5%<br>(f/2.66-2.94)                                                    | f/2.83           |
| <b>Distortion:</b><br>105mm: (±2.5%)                                                     | 1.13% (pincushn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>105mm: (0-1.1 stops) | 0.5 stops        |

## RESOLUTION

| KIRON 105mm f/2.8<br>at 105mm<br>at 1:49 |                  |                  |           |    |
|------------------------------------------|------------------|------------------|-----------|----|
| f/                                       | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 2.8                                      | Good             | 44               | Excellent | 39 |
| 4                                        | Good             | 49               | Excellent | 44 |
| 5.6                                      | Good             | 55               | Excellent | 49 |
| 8                                        | Good             | 55               | Excellent | 49 |
| 11                                       | Excellent        | 62               | Excellent | 55 |
| 16                                       | Excellent        | 62               | Excellent | 49 |
| 22                                       | V. Good          | 55               | Excellent | 49 |
| 32                                       | Excellent        | 49               | Excellent | 44 |

## CONTRAST

| KIRON 105mm f/2.8<br>at 105mm<br>at 30 lines/mm |               |               |        |    |
|-------------------------------------------------|---------------|---------------|--------|----|
| f/                                              | Center<br>(%) | Corner<br>(%) |        |    |
| 2.8                                             | High          | 53            | High   | 32 |
| 4                                               | High          | 57            | High   | 41 |
| 5.6                                             | High          | 60            | High   | 52 |
| 8                                               | High          | 63            | High   | 58 |
| 11                                              | High          | 64            | High   | 59 |
| 16                                              | High          | 62            | High   | 54 |
| 22                                              | High          | 58            | High   | 41 |
| 32                                              | High          | 40            | Medium | 29 |

## MACRO RESOLUTION

| KIRON 105mm f/2.8<br>at 105mm<br>at 1:4 |                  |                  |           |    |
|-----------------------------------------|------------------|------------------|-----------|----|
| f/                                      | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 2.8                                     | Excellent        | 57               | Excellent | 51 |
| 4                                       | Excellent        | 57               | Excellent | 51 |
| 5.6                                     | Excellent        | 64               | Excellent | 57 |
| 8                                       | Excellent        | 64               | Excellent | 57 |
| 11                                      | Excellent        | 57               | Excellent | 51 |
| 16                                      | Excellent        | 57               | Excellent | 51 |
| 22                                      | V. Good          | 51               | Excellent | 45 |
| 32                                      | V. Good          | 45               | Excellent | 40 |

## MACRO RESOLUTION

| KIRON 105mm f/2.8<br>at 105mm<br>at 1:1 |                  |                  |           |    |
|-----------------------------------------|------------------|------------------|-----------|----|
| f/                                      | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 2.8                                     | Good             | 40               | Excellent | 36 |
| 4                                       | Good             | 45               | Excellent | 40 |
| 5.6                                     | Good             | 50               | Excellent | 40 |
| 8                                       | Good             | 50               | Excellent | 40 |
| 11                                      | Good             | 45               | Excellent | 40 |
| 16                                      | Good             | 45               | V. Good   | 36 |
| 22                                      | Good             | 45               | Good      | 32 |
| 32                                      | Good             | 40               | V. Good   | 32 |

balances well on light and medium-sized SLRs; white-on-black metric distance scale and orange-on-black magnification scales on barrel judged legible, but blue-on-black foot-age scale is hard to see in dim light; depth-of-field scale marked from f/16-32 "for high magnification work" judged of limited use for

## PERFORMANCE

| Our Standard                                                                        | Tested            |
|-------------------------------------------------------------------------------------|-------------------|
| <b>Focal length:</b> ±5%<br>(380 to 420mm)                                          | 405.5mm           |
| <b>Max. aperture:</b> ±5%<br>(f/4.28 to f/4.73)                                     | f/4.55            |
| <b>Distortion:</b><br>±3.5%                                                         | 1.1% (pincushion) |
| <b>Light falloff:</b> at f/5.6,<br>+ 1 stop from theoretical limit<br>(0-1.0 stops) | 0.33 stops        |

## RESOLUTION

| EBC Fujinon 400mm f/4.5<br>at 1.49 magnification |                    |                    |           |    |
|--------------------------------------------------|--------------------|--------------------|-----------|----|
| f/no.                                            | Center<br>Lines/mm | Corner<br>Lines/mm |           |    |
| 4.5                                              | Excellent          | 50                 | Excellent | 36 |
| 5.6                                              | Excellent          | 56                 | Excellent | 36 |
| 8                                                | Excellent          | 56                 | Excellent | 40 |
| 11                                               | Excellent          | 50                 | Excellent | 44 |
| 16                                               | Excellent          | 45                 | Excellent | 44 |
| 22                                               | Excellent          | 45                 | Excellent | 44 |
| 32                                               | Excellent          | 40                 | Excellent | 40 |
| 45                                               | Excellent          | 36                 | Excellent | 36 |

## CONTRAST

| EBC Fujinon 400mm f/4.5<br>at 30 lines/mm |          |          |        |    |
|-------------------------------------------|----------|----------|--------|----|
| f/no.                                     | Center % | Corner % |        |    |
| 4.5                                       | Medium   | 36       | Medium | 28 |
| 5.6                                       | High     | 42       | High   | 32 |
| 8                                         | Medium   | 48       | Medium | 37 |
| 11                                        | High     | 47       | High   | 38 |
| 16                                        | High     | 43       | Medium | 33 |
| 22                                        | Medium   | 36       | Low    | 30 |
| 32                                        | High     | 30       | Medium | 24 |
| 45                                        | Medium   | 25       | High   | 22 |



general photography; excellent shiny black finish, very good workmanship throughout; built-in sliding sun shade is effective and easy to use.

**Field test slides:** Test slides showed good snap and contrast at all apertures, but central sharpness improved at f/5.6 and held at smaller apertures. Some color fringing was noticeable in the corners of the frame, but flare was well controlled throughout. At 1:4 magnification, detail was well rendered and performance was above average. At 1:2, macro image quality drops off just slightly. Overall, above average for a lens of this type.

**Optical bench analysis** (for optical experts only): On axis, slight under-corrected spherical aberration, slight red flare and axial astigmatism, all gone by f/8. Diffraction limited performance at f/8 on down. Off axis, slight skew-ray flare mixed with slight astigmatism, lateral color throughout. (September 1985)

## WIDE RANGING 28-210mm ONE-TOUCH KIRON

**Specifications:** 28-210mm f/4-5.6 Kiron; mounts for Canon, Konica, Minolta, Nikon, Olympus, Pentax, Yashica/Contax; No. 57610687; accepts 72mm filters; f/4 (5.6) to f/32 with half-stop detents except between f/22 and f/32; min. foc. dist.: 4 ft. (1.2m) in normal range, to 1:4 magnification in macro at 210mm; 5 1/8-in. long, 3 in. diam. (128.7x75mm); 29.6 oz. (840g); \$359.00.

**Practical comments:** Focuses smoothly to minimum distance in 200° clockwise turn of very wide (2 1/8 in.) textured zoom/focus collar, but only at focal lengths above approximately 60mm. At 28mm, minimum focusing distance is 8 ft. (2.5m); at 50mm, 5 ft. (1.5m)—both judged too far for shooting many types of subjects. To zoom from 28mm to 210mm, zoom/focus collar moves forward 1 3/4 in. with slightly stiff action, but holds settings well. Zooming action became smoother after some use.

To select macro range (possible at 70-210mm focal length settings only) zoom/focus ring turns past numerical distances to orange Macro setting at which point focusing is by smooth push-pull action. Small knurled set screw to left of macro mark will lock zoom and focus at one point when screwed in completely, but is less effective at damping zoom and focusing actions when screwed in partially.

All numerical scales large and legible except for blue-on-black footage scale which is hard to see in dim light. Dual aperture indices marked T (tele) and W (wide) clearly indicate effective aperture. Barrel includes red infrared focusing index, but there is no macro magnification scale—a minor inconvenience. Lens is reasonably light for its very wide focal-length range, nicely balanced and extremely well finished in satin black.

**Field test slides:** Transparencies generally crisp and snappy with fine detail well rendered at all focal lengths and apertures except corner images shot wide open. Corner sharpness improved noticeably at one stop down from maximum aperture and equalled center sharpness by f/8. Pincushion distortion noticeable at 28mm and 210mm focal lengths. Flare very well controlled throughout. Macro image quality outstanding, espe-

### MACRO RESOLUTION

| KIRON 28-210mm f/4-5.6<br>at 210mm<br>at 1:4 |                      |    |                      |    |
|----------------------------------------------|----------------------|----|----------------------|----|
| f/                                           | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 5.6                                          | V. Good              | 36 | Excellent            | 32 |
| 8                                            | Excellent            | 40 | Excellent            | 32 |
| 11                                           | Excellent            | 45 | V. Good              | 36 |
| 16                                           | Excellent            | 51 | Excellent            | 40 |
| 22                                           | Excellent            | 45 | V. Good              | 36 |
| 32                                           | Excellent            | 40 | V. Good              | 32 |

### PERFORMANCE

| Our Standard                                                                                                          |  | as Tested                          |  |
|-----------------------------------------------------------------------------------------------------------------------|--|------------------------------------|--|
| <b>Focal length: ±5%</b><br>(26.60-29.40mm)<br>(199.50-220.50mm)                                                      |  | 29.13mm<br>206.19mm                |  |
| <b>Aperture: ±5%</b><br>(f/3.80-4.20)<br>at 210mm: (f/5.32-5.88)                                                      |  | f/3.93<br>f/5.76                   |  |
| <b>Distortion:</b><br>28mm: (±2.5%)<br>210mm: (±3.5%)                                                                 |  | 1.08% (pincshn)<br>0.63% (pincshn) |  |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>28mm: (0.2.0 stops)<br>210mm: @f/8: (0-1.0 stops) |  | 1.1 stops<br>0.6 stops             |  |

### RESOLUTION

| KIRON 28-210mm f/4-5.6<br>at 28mm<br>at 1:49 |                      |    |                      |    |
|----------------------------------------------|----------------------|----|----------------------|----|
| f/                                           | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                                            | V. Good              | 49 | Excellent            | 39 |
| 5.6                                          | Excellent            | 55 | Excellent            | 44 |
| 8                                            | V. Good              | 55 | Excellent            | 49 |
| 11                                           | Excellent            | 62 | Excellent            | 49 |
| 16                                           | Excellent            | 55 | Excellent            | 49 |
| 22                                           | V. Good              | 49 | Excellent            | 44 |
| 32                                           | Excellent            | 49 | Excellent            | 44 |

### RESOLUTION

| KIRON 28-210mm f/4-5.6<br>at 105mm<br>at 1:50 |                      |    |                      |    |
|-----------------------------------------------|----------------------|----|----------------------|----|
| f/                                            | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                           | Excellent            | 50 | Excellent            | 45 |
| 5.6                                           | Excellent            | 56 | Excellent            | 50 |
| 8                                             | Excellent            | 63 | Excellent            | 56 |
| 11                                            | Excellent            | 63 | Excellent            | 56 |
| 16                                            | Excellent            | 56 | Excellent            | 50 |
| 22                                            | V. Good              | 50 | Excellent            | 45 |
| 32                                            | Excellent            | 50 | Excellent            | 45 |

### RESOLUTION

| KIRON 28-210mm f/4-5.6<br>at 210mm<br>at 1:51 |                      |    |                      |    |
|-----------------------------------------------|----------------------|----|----------------------|----|
| f/                                            | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 5.6                                           | Excellent            | 57 | Excellent            | 51 |
| 8                                             | Excellent            | 64 | Excellent            | 57 |
| 11                                            | Excellent            | 64 | Excellent            | 57 |
| 16                                            | Excellent            | 57 | Excellent            | 51 |
| 22                                            | Excellent            | 51 | Excellent            | 45 |
| 32                                            | Excellent            | 51 | Excellent            | 45 |

cially at middle apertures. Overall, an above average lens of this type.

**Optical bench analysis** (for optical experts only): On axis, at 28mm, very slight chromatic aberration with very slight undercorrected spherical aberration. Diffraction limited pattern by f/11. Off axis, at 28mm, slight skew-ray flare mixed with very slight astigmatism;

### Interchangeable Lenses

#### CONTRAST

| KIRON 28-210mm f/4-5.6<br>at 28mm<br>at 30 lines/mm |            |    |            |    |
|-----------------------------------------------------|------------|----|------------|----|
| f/                                                  | Center (%) |    | Corner (%) |    |
| 4                                                   | High       | 44 | High       | 34 |
| 5.6                                                 | High       | 58 | High       | 43 |
| 8                                                   | High       | 61 | High       | 50 |
| 11                                                  | High       | 62 | High       | 51 |
| 16                                                  | High       | 55 | High       | 46 |
| 22                                                  | High       | 44 | Medium     | 32 |
| 32                                                  | High       | 40 | Medium     | 30 |

#### CONTRAST

| KIRON 28-210mm f/4-5.6<br>at 105mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 4.5                                                  | High       | 46 | High       | 34 |
| 5.6                                                  | High       | 59 | High       | 45 |
| 8                                                    | High       | 61 | High       | 50 |
| 11                                                   | High       | 63 | High       | 52 |
| 16                                                   | High       | 52 | High       | 41 |
| 22                                                   | High       | 43 | Medium     | 33 |
| 32                                                   | High       | 38 | High       | 30 |

#### CONTRAST

| KIRON 28-210mm f/4-5.6<br>at 210mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 5.6                                                  | High       | 58 | High       | 45 |
| 8                                                    | High       | 60 | High       | 50 |
| 11                                                   | High       | 64 | High       | 52 |
| 16                                                   | High       | 51 | High       | 43 |
| 22                                                   | High       | 43 | Medium     | 34 |
| 32                                                   | High       | 38 | Medium     | 29 |

lateral color.

On axis, at 105mm, very slight chromatic and very slight over-corrected spherical aberration. Diffraction limited pattern by f/11. Off axis, at 105mm, slight skew-ray flare mixed with slight astigmatism; very slight lateral color present.

On axis, at 210mm, very slight axial color and very slight overcorrected spherical aberration. Diffraction limited pattern by f/16. Off axis, slight skew-ray flare mixed with slight coma, and a touch of lateral color. (January 1986)

## HANDY, ONE-TOUCH 28-105MM KIRON

**Specifications:** 28-105mm f/3.2 Kiron; mounts for Canon, Konica, Minolta, Nikon, Olympus, Pentax, Yashica/Contax; No. 36810924; accepts 67mm filters; f/3.2 to f/22, 1/2-stop detents between f/4 and f/16, no detents between f/3.2 and f/4, f/16 and f/22; min. foc. dist.: 4 ft. 6 in. (1.4m) at 105mm setting to 1:4 magnification at 28mm setting; 4 11/16 in. long, 2 3/4 in. diam. (120 x 70mm); 1 lb., 9 oz. (709g); \$359.

**Practical comments:** Smooth, bright black finish, well-balanced, relatively compact for a 28-105 f/3.2; focuses smoothly with well-damped action to minimum distance in 90° clockwise turn of 2 in.-wide textured rubber zoom/focus collar; zooms smoothly, if a bit sluggishly, from 28 to 105mm by pulling collar forward; holds all settings well; scales legibly engraved in white on black, except royal blue and white focusing index on barrel; vari-focal design must be refocused when focal



## Interchangeable Lenses

### RESOLUTION

| KIRON 28-105mm f/3.2-4.5<br>at 28mm<br>at 1:50 |                  |    |                  |    |
|------------------------------------------------|------------------|----|------------------|----|
| f/                                             | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.2                                            | Excellent        | 50 | Excellent        | 40 |
| 4                                              | Excellent        | 50 | Excellent        | 40 |
| 5.6                                            | Excellent        | 56 | Excellent        | 40 |
| 8                                              | Excellent        | 63 | Excellent        | 45 |
| 11                                             | Excellent        | 63 | Excellent        | 45 |
| 16                                             | Excellent        | 50 | Excellent        | 40 |
| 22                                             | Excellent        | 50 | Excellent        | 40 |

### CONTRAST

| KIRON 28-105mm f/3.2-4.5<br>at 28mm<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------------------------|---------------|----|---------------|----|
| f/                                                    | Center<br>(%) |    | Corner<br>(%) |    |
| 3.2                                                   | High          | 41 | High          | 36 |
| 4                                                     | High          | 58 | High          | 39 |
| 5.6                                                   | High          | 64 | High          | 40 |
| 8                                                     | High          | 66 | High          | 43 |
| 11                                                    | High          | 59 | Medium        | 38 |
| 16                                                    | High          | 51 | Medium        | 36 |
| 22                                                    | High          | 44 | Medium        | 32 |

### RESOLUTION

| KIRON 28-105mm f/3.2-4.5<br>at 45mm<br>at 1:49 |                  |    |                  |    |
|------------------------------------------------|------------------|----|------------------|----|
| f/                                             | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4                                              | V. Good          | 49 | Excellent        | 39 |
| 5.6                                            | V. Good          | 55 | V. Good          | 39 |
| 8                                              | Good             | 55 | Good             | 44 |
| 11                                             | V. Good          | 55 | V. Good          | 44 |
| 16                                             | V. Good          | 55 | V. Good          | 44 |
| 22                                             | Good             | 49 | V. Good          | 44 |

### CONTRAST

| KIRON 28-105mm f/3.2-4.5<br>at 45mm<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------------------------|---------------|----|---------------|----|
| f/                                                    | Center<br>(%) |    | Corner<br>(%) |    |
| 4                                                     | High          | 58 | Medium        | 25 |
| 5.6                                                   | High          | 69 | Medium        | 30 |
| 8                                                     | High          | 70 | Medium        | 35 |
| 11                                                    | High          | 59 | High          | 40 |
| 16                                                    | High          | 50 | Medium        | 38 |
| 22                                                    | Medium        | 46 | Medium        | 34 |

### RESOLUTION

| KIRON 28-105mm f/3.2-4.5<br>at 105mm<br>at 1:50 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/                                              | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4.5                                             | Excellent        | 56 | Excellent        | 35 |
| 5.6                                             | Excellent        | 56 | V. Good          | 35 |
| 8                                               | V. Good          | 56 | Excellent        | 40 |
| 11                                              | Excellent        | 56 | Excellent        | 40 |
| 16                                              | Excellent        | 56 | Excellent        | 40 |
| 22                                              | V. Good          | 50 | Excellent        | 40 |

### CONTRAST

| KIRON 28-105mm f/3.2-4.5<br>at 105mm<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------------------------|---------------|----|---------------|----|
| f/                                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 4.5                                                    | High          | 59 | Medium        | 27 |
| 5.6                                                    | High          | 69 | Medium        | 31 |
| 8                                                      | High          | 71 | Medium        | 36 |
| 11                                                     | High          | 59 | High          | 41 |
| 16                                                     | High          | 51 | High          | 36 |
| 22                                                     | High          | 47 | Medium        | 35 |

### PERFORMANCE

| Our Standard                                                                                                     | as Tested                            |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(26.60-29.40mm)<br>(99.75-110.25mm)                                            | 28.52mm<br>104.77mm                  |
| <b>Aperture:</b> $\pm 5\%$<br>(f/3.04-3.36)<br>at 105mm: (f/4.28-4.73)                                           | f/3.22<br>f/4.62                     |
| <b>Distortion:</b><br>28mm: ( $\pm 2.5\%$ )<br>105mm: ( $\pm 2.5\%$ )                                            | under 1% (barrel)<br>under 1% (pin.) |
| <b>Light falloff:</b> at f/5.6<br>+ 1 stop from theoretical limit<br>28mm: (0-2.0 stops)<br>105mm: (0-1.1 stops) | 1.2 stops<br>0.5 stops               |

length is changed, a minor inconvenience with this single-touch design; minimum focus of 4½ ft judged insufficient for tight head-and-shoulders portrait; focal length scale accurate only at infinity.

**Field test slides:** Crisp, snappy images with sharpness maintained from center to corners at all focal lengths. Sharpness improves noticeably two stops down. Some barrel distortion apparent at 28mm. Flare well-controlled with no apparent color fringing. Above average, commendably uniform performance for a zoom lens of this range and speed. At 1:4 magnification at 28mm (macro) corner resolution not acceptable; central sharpness judged good at f/5.6-f/22.

**Optical bench analysis:** (for optical experts only): At 105mm on axis, over-corrected spherical aberration, slight red flare, diffraction limited by f/8. Off axis, slight astigmatism mixed with very slight skew-ray flare. No lateral color.

At 45mm on axis, over-corrected spherical aberration, no color aberration, diffraction limited by f/8. Off axis, coma mixed with slight skew-ray flare, gone by f/8. No lateral color.

At 28mm, on axis, very slight undercorrected spherical aberration, with primary chromatic aberration, diffraction limited by f/5.6; very slight flare, gone by f/5.6. Off axis, very slight astigmatism, mixed with very slight coma, much improved by f/8; no lateral color. (August 1984)

## KIRON'S 70-210mm HAS ZOOM LOCK

**Specifications:** 70-210mm f/4 Kiron; mounts for Canon, Konica, Minolta, Nikon, Olympus, Pentax and Yashica/Contax; No. 36700112; accepts 62mm filters; f/4 to f/22, ½ stop detents; min. foc. dist. 3 ft. 9 in. (1.15m); max. magnification, 1:4 at 210mm; 6 in. long, 3 in. diam. (150 x 75 mm); 29 oz. (830 g); \$359.

**Practical comments:** Features include zoom locking switch which effectively prevents focal-length "creep" while focusing. Twin focus stops located on rings behind 3-in.-wide, one-touch zoom/focus collar, permit pre-setting focus distances for near and far ranges. Close focusing achieved without switching to macro mode, continuous at all focal lengths; glossy black front barrel does not rotate, aiding special-effects filter use; bulk and finder brightness average for range.

**Field test slides:** No noticeable distortion. Detail crisp, snappy and well rendered, especially at f/5.6 and smaller. Flare very well con-

### RESOLUTION

| Kiron 35-135mm f/3.5-4.5<br>at 135mm<br>at 1:50 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/no.                                           | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4.5                                             | Good             | 40 | Excellent        | 32 |
| 5.6                                             | Good             | 45 | V. Good          | 35 |
| 8                                               | Good             | 50 | Excellent        | 45 |
| 11                                              | V. Good          | 50 | Excellent        | 45 |
| 16                                              | Good             | 45 | Excellent        | 45 |
| 22                                              | Good             | 45 | Excellent        | 40 |

### CONTRAST

| Kiron 35-135mm f/3.5-4.5<br>at 135mm<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------------------------|---------------|----|---------------|----|
| f/no.                                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 4.5                                                    | High          | 42 | Medium        | 24 |
| 5.6                                                    | High          | 51 | Medium        | 27 |
| 8                                                      | High          | 52 | Medium        | 34 |
| 11                                                     | High          | 54 | High          | 36 |
| 16                                                     | High          | 52 | High          | 41 |
| 22                                                     | High          | 54 | High          | 40 |

### RESOLUTION

| Kiron 70-210mm f/4<br>at 70mm<br>at 1:49.01 |                  |    |                  |    |
|---------------------------------------------|------------------|----|------------------|----|
| f/                                          | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4                                           | Good             | 44 | Excellent        | 39 |
| 5.6                                         | Accept           | 44 | Excellent        | 44 |
| 8                                           | Accept           | 49 | Excellent        | 44 |
| 11                                          | Good             | 49 | Excellent        | 44 |
| 16                                          | Good             | 49 | Excellent        | 44 |
| 22                                          | Good             | 49 | Excellent        | 44 |

### CONTRAST

| Kiron 70-210mm f/4<br>at 70mm<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------------------|---------------|----|---------------|----|
| f/                                              | Center<br>(%) |    | Corner<br>(%) |    |
| 4                                               | High          | 57 | High          | 40 |
| 5.6                                             | High          | 63 | High          | 47 |
| 8                                               | High          | 63 | High          | 53 |
| 11                                              | High          | 62 | High          | 57 |
| 16                                              | High          | 57 | High          | 52 |
| 22                                              | High          | 52 | High          | 44 |

### RESOLUTION

| Kiron 70-210mm f/4<br>at 135mm<br>at 1:50 |                  |    |                  |    |
|-------------------------------------------|------------------|----|------------------|----|
| f/                                        | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4                                         | V. Good          | 45 | Excellent        | 32 |
| 5.6                                       | Good             | 45 | V. Good          | 32 |
| 8                                         | Accept           | 45 | Excellent        | 45 |
| 11                                        | V. Good          | 50 | Excellent        | 45 |
| 16                                        | V. Good          | 50 | Excellent        | 40 |
| 22                                        | V. Good          | 50 | Good             | 35 |

### CONTRAST

| Kiron 70-210mm f/4<br>at 135mm<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------------------|---------------|----|---------------|----|
| f/                                               | Center<br>(%) |    | Corner<br>(%) |    |
| 4                                                | High          | 54 | High          | 56 |
| 5.6                                              | High          | 64 | High          | 59 |
| 8                                                | High          | 65 | High          | 62 |
| 11                                               | High          | 64 | High          | 58 |
| 16                                               | High          | 61 | High          | 57 |
| 22                                               | High          | 50 | High          | 57 |



## PERFORMANCE

| Our Standard                                                                                                    | as Tested                                   |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(66.50-73.50mm)<br>(199.50-220.50mm)                                          | 72.42mm<br>205.20mm                         |
| <b>Aperture:</b> $\pm 5\%$<br>70mm: (f/3.80-4.20)<br>210mm: (f/3.80-4.20)                                       | f/4.11<br>f/4.16                            |
| <b>Distortion:</b><br>70mm: ( $\pm 2\%$ )<br>210mm: ( $\pm 3.5\%$ )                                             | 1.64% (barrel)<br>less than 1% (pincushion) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.0 stops) | 1.1 stops<br>1.0 stops                      |

rected, especially at f/5.6 and smaller. Some underexposure noted at maximum aperture. Overall, above average performance for type, though macro performance was slightly below average.

**Optical bench analysis** (for optical experts only): At 70mm, on axis; very slight flare at f/4. Near diffraction limit by f/5.6. Off axis: Slight flare, gone by f/8; slight lateral color.

At 135mm, on axis: Very slight flare to f/8. Near diffraction limit by f/8. Off axis: Slight flare gone by f/8; slight lateral color.

At 210mm, on axis: as above. Off axis, as above, plus very slight high-order coma to f/8. (November 1983).

## 80-200mm f/4.5 KIRON WITH 'ZOOMLOCK'

**Specifications:** 80-200mm f/4.5 Kiron MC; no. 26406492; Nikon AI, Canon FD, Minolta MD, Olympus, Pentax, Yashica-Contax, Konica mounts; accepts 55mm filters; f/4.5 to f/32 with half-stop detents except between f/4.5 and f/5.6 and f/22 and f/32; min. foc. dist. 3.5 ft. (1.1m) in "macro" (1:4 at 200mm); 5 3/4 in. long, 2 1/2 in. diam. (146mm x 64mm); 1 lb., 6 1/8 oz. (629g); \$259.

**Practical comments:** "Zoomlock" is a unique feature allowing locking-in the focal length at any point along the entire range thus preventing unwanted focal-length shifts occurring with single-touch zooms. Rubberized, studded, 2 3/4 in.-wide control ring is used for one-touch zoom/focus with continuous focusing to "macro" position. Smooth, well-damped movement facilitates easy control, zoom lock definitely prevented any tendency of zoom control to slip when lens is pointed downward. Kiron's distinctive blue footage numerals, white meter, focal length and f/stop numerals are easy to read. Built-in lens hood extends 1/2 in. over lens lip when focused to "macro" position.

**Field test slides:** Crisp, clean images throughout at all focal lengths, though slightly

## PERFORMANCE

| Our Standard                                                                                                    | Tested                                  |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(76.00-84.00mm)<br>(190.00-210.00mm)                                          | 82.38mm<br>196.35mm                     |
| <b>Aperture:</b> $\pm 5\%$<br>(f/4.28-f/4.73)<br>at 200mm: (f/4.28-4.73)                                        | f/4.59<br>f/4.60                        |
| <b>Distortion:</b><br>80mm: ( $\pm 2\%$ )<br>200mm: ( $\pm 2.5\%$ )                                             | less than 1% (barrel)<br>1.01% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>80mm: (0-1.2 stops)<br>200mm: (0-1.0 stops) | 0.80 stops<br>1.00 stops                |

## RESOLUTION

| Kiron 80-200mm f/4.5<br>at 80mm<br>at 1:47.2 |                  |                  |           |    |
|----------------------------------------------|------------------|------------------|-----------|----|
| f/no.                                        | Center<br>(1/mm) | Corner<br>(1/mm) |           |    |
| 4.5                                          | Excellent        | 53               | Excellent | 42 |
| 5.6                                          | V. Good          | 53               | Excellent | 47 |
| 8                                            | V. Good          | 59               | Excellent | 53 |
| 11                                           | Excellent        | 59               | Excellent | 53 |
| 16                                           | V. Good          | 53               | Excellent | 53 |
| 22                                           | Good             | 47               | Excellent | 47 |
| 32                                           | V. Good          | 42               | Excellent | 37 |

## CONTRAST

| Kiron 80-200mm f/4.5<br>at 80mm<br>at 30 lines/mm |            |            |      |    |
|---------------------------------------------------|------------|------------|------|----|
| f/no.                                             | Center (%) | Corner (%) |      |    |
| 4.5                                               | High       | 44         | High | 44 |
| 5.6                                               | High       | 55         | High | 50 |
| 8                                                 | High       | 56         | High | 54 |
| 11                                                | High       | 56         | High | 60 |
| 16                                                | High       | 52         | High | 60 |
| 22                                                | High       | 46         | High | 50 |
| 32                                                | High       | 40         | High | 38 |

## RESOLUTION

| Kiron 80-200mm f/4.5<br>at 135mm<br>at 1:47.2 |                  |                  |           |    |
|-----------------------------------------------|------------------|------------------|-----------|----|
| f/no.                                         | Center<br>(1/mm) | Corner<br>(1/mm) |           |    |
| 4.5                                           | Excellent        | 53               | Excellent | 42 |
| 5.6                                           | Excellent        | 59               | Excellent | 47 |
| 8                                             | V. Good          | 59               | Excellent | 47 |
| 11                                            | V. Good          | 53               | Excellent | 53 |
| 16                                            | V. Good          | 53               | Excellent | 47 |
| 22                                            | Good             | 47               | Excellent | 42 |
| 32                                            | V. Good          | 42               | Excellent | 37 |

## CONTRAST

| Kiron 80-200mm f/4.5<br>at 135mm<br>at 30 lines/mm |            |            |      |    |
|----------------------------------------------------|------------|------------|------|----|
| f/no.                                              | Center (%) | Corner (%) |      |    |
| 4.5                                                | High       | 46         | High | 50 |
| 5.6                                                | High       | 58         | High | 51 |
| 8                                                  | High       | 56         | High | 52 |
| 11                                                 | High       | 60         | High | 52 |
| 16                                                 | High       | 53         | High | 48 |
| 22                                                 | High       | 42         | High | 44 |
| 32                                                 | High       | 45         | High | 50 |

## RESOLUTION

| Kiron 80-200mm f/4.5<br>at 200mm<br>at 1:49 |                  |                  |           |    |
|---------------------------------------------|------------------|------------------|-----------|----|
| f/no.                                       | Center<br>(1/mm) | Corner<br>(1/mm) |           |    |
| 4.5                                         | Excellent        | 44               | Excellent | 35 |
| 5.6                                         | Excellent        | 44               | Excellent | 39 |
| 8                                           | Good             | 44               | V. Good   | 39 |
| 11                                          | V. Good          | 44               | V. Good   | 39 |
| 16                                          | Good             | 39               | Good      | 35 |
| 22                                          | Good             | 39               | Good      | 35 |
| 32                                          | V. Good          | 35               | V. Good   | 31 |

## CONTRAST

| Kiron 80-200mm f/4.5<br>at 200mm<br>at 30 lines/mm |            |            |        |    |
|----------------------------------------------------|------------|------------|--------|----|
| f/no.                                              | Center (%) | Corner (%) |        |    |
| 4.5                                                | Medium     | 37         | High   | 35 |
| 5.6                                                | Medium     | 39         | High   | 38 |
| 8                                                  | High       | 48         | High   | 39 |
| 11                                                 | High       | 50         | High   | 36 |
| 16                                                 | High       | 47         | Medium | 34 |
| 22                                                 | High       | 47         | High   | 38 |
| 32                                                 | High       | 50         | High   | 50 |

## Interchangeable Lenses

softer at maximum aperture. Fine detail is well-defined, especially by f/8.

**Optical bench analysis** (for optical experts only): At 80mm: On-axis, slight spherical aberration to f/8, very slight yellow flare to f/5.6, near diffraction limited by f/8. Off-axis, slight astigmatism to f/11, very slight high order coma to f/11, almost no lateral color.

At 135mm: On-axis, slight violet flare to f/5.6, slight yellow flare to f/11, near diffraction limited by f/11. Off-axis, slight flare to f/11, very slight lateral color.

At 200mm: On-axis, slight spherical aberration and flare to f/11. Off-axis, slight coma to f/11, very slight lateral color throughout. (September 1983)

## WIDE-TO-TELE ZOOM FOR KONICA

**Specifications:** 28-135mm f/4-4.6 Konica Zoom-Hexanon AR in Konica mount; No. 9710483; accepts 67mm screw-in filters; f/4 to f/22 with full stop detents; min. foc. dist. 20 in. (.5m); 4 3/4 in. long, 2 3/4 in. diam. (120 x 70mm); 28 oz. (797g); \$566.

**Practical comments:** Combined zooming and focusing controls; 2 1/2-in. wide rubberized, studded zooming/focusing ring; clear, well-defined color-coded focal length, and distance (feet in orange, meters in white) scales; clear white-on-black aperture scale but too small; smooth focus control with continuous focus from infinity to minimum setting in 90° at 28mm focal length, 75° at 135mm focal length; slightly stiff zooming control insures positive settings; above average weight, relatively compact dimensions for lens of this focal length range helps balance and handling.

**Field test slides:** Flare well controlled throughout, especially at wider focal lengths. Barrel distortion evident at 28mm, pincushion at 135mm. Images appeared crisp and snappy at all focal lengths. Overall sharpness was good but corners appeared somewhat soft, especially at wider apertures. A slightly above average performance overall.

**Optical bench analysis:** (for optical experts only): At 28mm, on axis—slight over-corrected spherical aberration, yellow flare present but near theoretical diffraction limit by f/8. Off axis, slight coma noted but near theoretical diffraction limit by f/5.6. Lateral color throughout.

At 50mm, on axis, slight over-corrected spherical aberration present at widest apertures. Yellow flare present but near theoretical diffraction limit by f/11. Off axis, slight

## PERFORMANCE

| Our Standard                                                                                                    | as Tested                         |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(26.60-29.40mm)<br>(128.25-141.75mm)                                          | 28.37mm<br>131.31mm               |
| <b>Aperture:</b> $\pm 5\%$<br>(f/3.80-4.20)<br>at 135mm: (f/4.37-4.83)                                          | f/4.03<br>f/4.61                  |
| <b>Distortion:</b><br>28mm: ( $\pm 2.5\%$ )<br>135mm: ( $\pm 2.5\%$ )                                           | 1.84% (barrel)<br>1.5% (pincush.) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>28mm: (0-2.0 stops)<br>135mm: (0-1.1 stops) | 1.3 stops<br>0.9 stops            |



## Interchangeable Lenses

### RESOLUTION

| KONICA 28-135mm f/4.0-4.6<br>at 28mm<br>at 1:49 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/                                              | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4                                               | Excellent        | 62 | Excellent        | 39 |
| 5.6                                             | Excellent        | 62 | Excellent        | 44 |
| 8                                               | Excellent        | 69 | Excellent        | 44 |
| 11                                              | Excellent        | 62 | Excellent        | 39 |
| 16                                              | Excellent        | 55 | Excellent        | 39 |
| 22                                              | V. Good          | 49 | Excellent        | 39 |

### CONTRAST

| KONICA 28-135mm f/4.0-4.6<br>at 28mm<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------------------------|---------------|----|---------------|----|
| f/                                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 4                                                      | High          | 43 | High          | 35 |
| 5.6                                                    | High          | 54 | High          | 39 |
| 8                                                      | High          | 59 | High          | 43 |
| 11                                                     | High          | 56 | High          | 40 |
| 16                                                     | High          | 50 | Medium        | 38 |
| 22                                                     | Medium        | 43 | Medium        | 33 |

### RESOLUTION

| KONICA 28-135mm f/4.0-4.6<br>at 50mm<br>at 1:50 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/                                              | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4.2                                             | Excellent        | 56 | Excellent        | 45 |
| 5.6                                             | Excellent        | 63 | Excellent        | 50 |
| 8                                               | Excellent        | 63 | Excellent        | 50 |
| 11                                              | Excellent        | 56 | Excellent        | 50 |
| 16                                              | V. Good          | 50 | Excellent        | 45 |
| 22                                              | Good             | 45 | Excellent        | 45 |

### CONTRAST

| KONICA 28-135mm f/4.0-4.6<br>at 50mm<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------------------------|---------------|----|---------------|----|
| f/                                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 4.2                                                    | High          | 58 | Medium        | 25 |
| 5.6                                                    | High          | 68 | Medium        | 31 |
| 8                                                      | High          | 69 | Medium        | 35 |
| 11                                                     | High          | 58 | High          | 40 |
| 16                                                     | High          | 49 | Medium        | 37 |
| 22                                                     | Medium        | 46 | Medium        | 33 |

### RESOLUTION

| KONICA 28-135mm f/4.0-4.6<br>at 135mm<br>at 1:50 |                  |    |                  |    |
|--------------------------------------------------|------------------|----|------------------|----|
| f/                                               | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4.6                                              | V. Good          | 45 | Excellent        | 40 |
| 5.6                                              | V. Good          | 50 | Excellent        | 45 |
| 8                                                | V. Good          | 56 | Excellent        | 45 |
| 11                                               | Excellent        | 56 | Excellent        | 45 |
| 16                                               | V. Good          | 50 | Excellent        | 45 |
| 22                                               | Good             | 45 | Excellent        | 40 |

### CONTRAST

| KONICA 28-135mm f/4.0-4.6<br>at 135mm<br>at 30 lines/mm |               |    |               |    |
|---------------------------------------------------------|---------------|----|---------------|----|
| f/                                                      | Center<br>(%) |    | Corner<br>(%) |    |
| 4.6                                                     | High          | 49 | Medium        | 28 |
| 5.6                                                     | High          | 69 | High          | 32 |
| 8                                                       | High          | 70 | Medium        | 38 |
| 11                                                      | High          | 58 | High          | 37 |
| 16                                                      | High          | 56 | Medium        | 34 |
| 22                                                      | High          | 49 | Medium        | 32 |

skew-ray flare mixed with astigmatism but near theoretical diffraction limit by f/8. Lateral color throughout.

135mm, on axis, decentering noted causing coma but gone by f/5.6. Near theoretical diffraction limit by f/8. Off axis, slight coma mixed with astigmatism but near theoretical diffraction limit by f/11. Lateral color throughout. (August 1984)

## ULTRA COMPACT WIDE ANGLES FOR LEICA

**Specifications:** 28mm f/2.8 Elmarit-M No. 3206143; bayonet mount for M-Leicas only; accepts 43mm x 1/2mm threaded filters, f/2.8-22 with detents at half-stop intervals; min. foc. dist.: 2.5 ft. (0.7m); 1 15/16-in. long, 2 in. diam.; 2 7/8 oz. \$720 with bayonet hood and caps.

35mm f/2 Summicron-M, No. 3307201; bayonet mount for M-Leicas only; accepts 39mm x 1/2mm threaded filters, rectangular hood locks in proper alignment; f/2-16 with detents at half-stop intervals. Min. foc. dist.: 2.5 ft. 0.7m; 1 in. long, 2 in. diam.; 4 3/4 oz. \$645 with clip on hood and caps.

**Practical comments:** Both lenses share the same high quality satin-black finish, color-coded, legible scales and compact size of rangefinder wide angles. Both have new formulas, the 28 having 8 elements and 6 groups and the 35mm Summicron with 7 elements in 5 groups. Both focus and stop down in the same direction for consistent handling and have parallel knurled metal operating rings.

**Field test slides:** Transparencies taken with the 28mm were sharp and contrasty. Central sharpness was uniformly very high. Corners

### PERFORMANCE

| Our Standard                                                                       |  | as Tested       |  |
|------------------------------------------------------------------------------------|--|-----------------|--|
| <b>Focal length: ±5%</b><br>(33.25-36.75mm)                                        |  | 35.69mm         |  |
| <b>Aperture: ±5%</b><br>(f/1.90-2.10)                                              |  | f/2.01          |  |
| <b>Distortion:</b><br>(±2.5%)                                                      |  | 0.24% (pinchsn) |  |
| <b>Light falloff: at f/5.6</b><br>+ 1 stop from theoretical limit<br>(0-1.9 stops) |  | 0.4 stops       |  |

### RESOLUTION

| SUMMICRON-M 35mm f/2<br>at 1:50 |                      |    |                      |    |
|---------------------------------|----------------------|----|----------------------|----|
| f/                              | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 2                               | Excellent            | 56 | Excellent            | 45 |
| 2.8                             | Excellent            | 63 | Excellent            | 50 |
| 4                               | Excellent            | 70 | Excellent            | 50 |
| 5.6                             | Excellent            | 70 | Excellent            | 50 |
| 8                               | Excellent            | 80 | Excellent            | 56 |
| 11                              | Excellent            | 70 | Excellent            | 50 |
| 16                              | Excellent            | 63 | Excellent            | 50 |

### CONTRAST

| SUMMICRON-M 35mm f/2<br>at 30 lines/mm |            |    |            |    |
|----------------------------------------|------------|----|------------|----|
| f/                                     | Center (%) |    | Corner (%) |    |
| 2                                      | High       | 51 | High       | 42 |
| 2.8                                    | High       | 56 | High       | 49 |
| 4                                      | High       | 64 | High       | 54 |
| 5.6                                    | High       | 70 | High       | 61 |
| 8                                      | High       | 71 | High       | 59 |
| 11                                     | High       | 64 | High       | 52 |
| 16                                     | High       | 61 | High       | 50 |

### PERFORMANCE

| Our Standard                                                                       |  | as Tested      |  |
|------------------------------------------------------------------------------------|--|----------------|--|
| <b>Focal length: ±5%</b><br>(26.60-29.40mm)                                        |  | 28.98mm        |  |
| <b>Aperture: ±5%</b><br>(f/2.66-2.94)                                              |  | f/2.92         |  |
| <b>Distortion:</b><br>(±2.5%)                                                      |  | 0.51% (barrel) |  |
| <b>Light falloff: at f/5.6</b><br>+ 1 stop from theoretical limit<br>(0-2.0 stops) |  | 0.6 stops      |  |

### RESOLUTION

| ELMARIT-M 28mm f/2.8<br>at 1:50 |                      |    |                      |    |
|---------------------------------|----------------------|----|----------------------|----|
| f/                              | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 2.8                             | Excellent            | 63 | Excellent            | 45 |
| 4                               | Excellent            | 70 | Excellent            | 50 |
| 5.6                             | Excellent            | 80 | Excellent            | 56 |
| 8                               | Excellent            | 80 | Excellent            | 56 |
| 11                              | Excellent            | 70 | Excellent            | 56 |
| 16                              | Excellent            | 63 | Excellent            | 50 |
| 22                              | Excellent            | 56 | Excellent            | 50 |

### CONTRAST

| ELMARIT-M 28mm f/2.8<br>at 30 lines/mm |            |    |            |    |
|----------------------------------------|------------|----|------------|----|
| f/                                     | Center (%) |    | Corner (%) |    |
| 2.8                                    | High       | 57 | High       | 45 |
| 4                                      | High       | 62 | High       | 50 |
| 5.6                                    | High       | 69 | High       | 56 |
| 8                                      | High       | 71 | High       | 60 |
| 11                                     | High       | 65 | High       | 54 |
| 16                                     | High       | 62 | High       | 50 |
| 22                                     | High       | 57 | Medium     | 46 |

were very slightly soft at f/2.8 but equaled center by f/5.6. Some light fall-off was noted, disappeared by f/4. Flare was well-controlled throughout. Some barrel distortion was noticeable. Well above average performance for this focal length.

Slides taken with the 35mm Summicron were sharp and snappy at all apertures. Slight softness in corners at f/2, improved by f/2.8. Some light fall-off noticed wide open, gone by f/4. Flare well-controlled throughout. Above average performance.

Slides taken with the 35mm Summicron were sharp and snappy at all apertures. Slight softness in corners at f/2, improved by f/2.8. Some light fall-off noticed wide open, gone by f/4. Flare well-controlled throughout. Again, a superior performer.

**Optical bench report** (for optical experts only): 28mm Elmarit-M showed very slight over-corrected spherical aberration and very slight red flare on axis; gone by f/5.6. Diffraction limited performance by f/5.6. Off axis, very slight skew-ray flare mixed with slight coma was seen. Some lateral color.

The 35mm f/2 Summicron showed very slight over-corrected spherical aberration, very slight red flare on axis, gone by f/5.6. Diffraction limited by f/8. Off axis, we saw very slight astigmatism mixed with slight coma and lateral color. (March 1986)

## MINOLTA 75-300mm AF TELE ZOOM

**Specifications:** 75-300mm f/4.5-5.6 Autofocus Minolta Zoom, No. 1001912 in Maxxum mount; accepts 55mm accessories; f/4.5 (5.6) to f/32; no aperture



markings on lens; 13 elements in 11 groups; focus to 15 feet at "Limit" setting; to five feet at "Full" macro setting; 6 7/16 inches long, 2 7/8 inches diameter (165x73mm), 1 lb. 14 oz. (858g). \$667.

**Practical comments:** Somewhat front-heavy lens balances well on Maxxum body. Wide, rubberized zoom turns from 75-300mm in one 90 degree clockwise motion. Slightly sticky zooming action under 200mm. Some collar creep from 200mm-75mm. Full/Limit switch on left side permits full range (five feet to infinity) focus at Full; Limit setting permits only partial (15 feet to infinity or five-15 feet) focus range. One-quarter inch wide manual focusing ring operates smoothly.

**Field test slides:** Transparencies were snappy, with good contrast at all focal lengths. Detail was very well rendered throughout. Detail at macro setting was above average for a zoom lens. Flare was very well controlled throughout zoom and aperture range. This lens yielded a consistent image through the frame and all focal lengths. Overall performance was above average for this type of lens.

**Optical bench analysis:** At 75mm, on axis, very slight over-corrected spherical, very slight yellow/red flare, gone by f/8. Diffraction limited by f/16. Off axis, very slight coma mixed with very slight astigmatism, gone by f/11. Lateral color present.

At 200mm, on axis, very slight over-corrected spherical very slight yellow-red

#### RESOLUTION

##### MAXXUM 75-300mm f/4.5-5.6 at 75mm/1:50

| f/  | Center<br>(l/mm) | Corner<br>(l/mm) |              |
|-----|------------------|------------------|--------------|
| 4.5 | Excellent        | 50               | Excellent 45 |
| 5.6 | V. Good          | 50               | Excellent 45 |
| 8   | V. Good          | 56               | Excellent 50 |
| 11  | Excellent        | 63               | Excellent 56 |
| 16  | Excellent        | 56               | Excellent 50 |
| 22  | Excellent        | 56               | Excellent 50 |
| 32  | Excellent        | 50               | Excellent 45 |

##### at 200mm/1:50

| f/  | Center<br>(l/mm) | Corner<br>(l/mm) |              |
|-----|------------------|------------------|--------------|
| 5   | Excellent        | 50               | Excellent 45 |
| 5.6 | Excellent        | 50               | Excellent 45 |
| 8   | Excellent        | 56               | Excellent 50 |
| 11  | Excellent        | 56               | Excellent 50 |
| 16  | Excellent        | 50               | Excellent 45 |
| 22  | Excellent        | 50               | Excellent 45 |
| 32  | Excellent        | 45               | Excellent 40 |

##### at 300mm/1:50

| f/  | Center<br>(l/mm) | Corner<br>(l/mm) |              |
|-----|------------------|------------------|--------------|
| 5.6 | Excellent        | 45               | Excellent 40 |
| 8   | Excellent        | 50               | Excellent 45 |
| 11  | Excellent        | 56               | Excellent 50 |
| 16  | Excellent        | 50               | Excellent 45 |
| 22  | Excellent        | 50               | Excellent 45 |
| 32  | Excellent        | 45               | Excellent 40 |

#### MACRO RESOLUTION

##### MAXXUM 75-300mm f/4.5-5 at 300mm/1:4

| f/  | Center<br>(l/mm) | Corner<br>(l/mm) |              |
|-----|------------------|------------------|--------------|
| 5.6 | Good             | 32               | V. Good 29   |
| 8   | V. Good          | 36               | Excellent 32 |
| 11  | V. Good          | 40               | Good 32      |
| 16  | V. Good          | 40               | V. Good 36   |
| 22  | Good             | 36               | Good 32      |
| 32  | Good             | 32               | Good 29      |

flare gone by f/11. Diffraction limited by f/16. Off axis, very slight coma mixed with very slight astigmatism was gone by f/16. Lateral color present.

At 300mm, on axis, very slight over-corrected spherical. Very slight yellow flare almost gone by f/11. Diffraction limited by f/22. Off axis, very slight coma mixed with very slight astigmatism was gone by f/16. Lateral color was present.

#### CONTRAST

##### at 75mm/30 lines/mm

| f/  | Center<br>(%) | Corner<br>(%) |           |
|-----|---------------|---------------|-----------|
| 4.5 | High          | 52            | High 40   |
| 5.6 | High          | 64            | High 52   |
| 8   | High          | 66            | High 52   |
| 11  | High          | 58            | High 49   |
| 16  | High          | 55            | High 45   |
| 22  | High          | 44            | Medium 34 |
| 32  | Medium        | 32            | Medium 29 |

##### at 200mm/30 lines/mm

| f/  | Center<br>(%) | Corner<br>(%) |           |
|-----|---------------|---------------|-----------|
| 5   | High          | 54            | High 42   |
| 5.6 | High          | 60            | High 51   |
| 8   | High          | 65            | High 52   |
| 11  | High          | 58            | High 49   |
| 16  | High          | 54            | High 44   |
| 22  | High          | 44            | Medium 32 |
| 32  | Medium        | 31            | Medium 29 |

##### at 300mm/30 lines/mm

| f/  | Center<br>(%) | Corner<br>(%) |           |
|-----|---------------|---------------|-----------|
| 5.6 | High          | 55            | High 42   |
| 8   | High          | 60            | High 52   |
| 11  | High          | 58            | High 47   |
| 16  | High          | 52            | High 42   |
| 22  | High          | 43            | Medium 38 |
| 32  | Medium        | 30            | Medium 28 |

#### PERFORMANCE

| Our Standard                                                                                                     | As Tested                          |
|------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length: ± 5%</b><br>( 71.25- 78.75mm)<br>(285.00-315.00mm)                                              | 77.78mm<br>299.06mm                |
| <b>Aperture: ± 5%</b><br>(f/4.28-4.73)<br>at 300 mm: (f/5.32-5.88)                                               | f/4.52<br>f/5.87                   |
| <b>Distortion:</b><br>75mm: (± 2%)<br>300mm: (± 3.5%)                                                            | 0.94% (barrel)<br>1.44% (pincushn) |
| <b>Light falloff: at f/5.6</b><br>+ 1 stop from theoretical limit<br>75mm: (0-1.2 stops)<br>300mm: (0-1.0 stops) | 0.4 stops<br>0.9 stops             |

### MAXXUM 28mm F/2.8, 35-105mm f/3.5-4.5

**Specifications:** 28mm f/2.8 Maxxum AF, No. 1020960, in mount for Minolta A; accepts 49mm accessories; f/2.8-22 set via camera; min. foc. dist.: 1 ft. (0.3m); max. foc. time: 0.35 sec.; 2<sup>9</sup>/<sub>16</sub>-in. long, 1<sup>11</sup>/<sub>16</sub>-in. diam. (66x42mm); 7<sup>7</sup>/<sub>16</sub> oz. (200g). \$149.00.

**Specifications:** 35-105mm f/3.5-4.5 Maxxum AF, No. 1006157, in mount for Minolta A; accepts 55mm accessories, f/3.5 to 22 set via camera; min. foc. dist.: 4 ft. 11 in. (1.5m); 1:4 macro at 105mm setting; 90° counter-clockwise turn from close focus to infinity, max. foc. time: 0.55 sec.; 3<sup>7</sup>/<sub>16</sub>-in. long, 2<sup>11</sup>/<sub>16</sub>-in. diam. (87x68mm), 1 lb. 1<sup>1</sup>/<sub>2</sub> oz. (495g). \$412.00.

**Practical comments:** Nicely finished, with coupling and built-in ROM (read only memory) for camera-controlled autofocus and aperture setting (no manual aperture setting ring or information on lens barrel). Narrow (1<sup>1</sup>/<sub>8</sub> in.) ribbed manual focusing ring turns smoothly in manual-focus mode. Distance scales clearly visible in window atop barrel with footages displayed in yellow, meters in white.

28mm consists of 5 elements in 5 groups; has 5<sup>8</sup>/<sub>16</sub>-in. wide rubberized grip most of barrel, depth-of-field scale, IR focus mark, and built-in lens shade. Slightly larger and heavier than average for a 28mm f/2.8 lens.

35-105mm two-touch has 14 elements in 12 groups; slide silver button forward and turn ribbed, rubberized 1-in. wide zoom control for macro-focusing to 1:4; IR focus marks for 35, 50, 70, and 105mm settings; detachable lens shade clips onto outside of lens allowing normal use of filters and lens cap. Although slightly larger and heavier than many current wide-to-tele zooms, lens offers excellent balance and performance.

**Field test slides:** Our slides taken with the 28mm f/2.8 were crisp and snappy with detail well rendered throughout. Corner detail was equal to center by f/4. Flare was well controlled throughout. Barrel distortion was just noticeable. Overall, above average performance for wide-angle lens.

Slides taken with the 35-105mm f/3.5-4.5 were crisp and snappy with detail well rendered at all focal lengths. Center and corner sharpness were equal once lens was closed down 2 stops. Flare was well controlled throughout at all apertures and focal lengths. Performance was above average for wide-to-tele zoom of this type.

**Optical bench analysis** (for optical experts only): On axis, the 28mm f/2.8 exhibited very

#### PERFORMANCE

| Our Standard                                                                       | as Tested      |
|------------------------------------------------------------------------------------|----------------|
| <b>Focal length: ± 5%</b><br>(26.60-29.40mm)                                       | 28.67mm        |
| <b>Aperture: ± 5%</b><br>(f/2.66-2.94)                                             | f/2.86         |
| <b>Distortion:</b><br>(± 2.5%)                                                     | 0.69% (barrel) |
| <b>Light falloff: at f/5.6</b><br>+ 1 stop from theoretical limit<br>(0-2.0 stops) | 0.7 stops      |

#### RESOLUTION

##### MAXXUM AF 28mm f/2.8 at 1:49

| f/  | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |              |
|-----|----------------------|----------------------|--------------|
| 2.8 | Good                 | 49                   | Excellent 44 |
| 4   | V. Good              | 55                   | Excellent 49 |
| 5.6 | V. Good              | 62                   | Excellent 55 |
| 8   | V. Good              | 62                   | Excellent 55 |
| 11  | Excellent            | 62                   | Excellent 55 |
| 16  | V. Good              | 55                   | Excellent 49 |
| 22  | Good                 | 49                   | V. Good 44   |

#### CONTRAST

##### MAXXUM AF 28mm f/2.8 at 30 lines/mm

| f/  | Center (%) | Corner (%) |           |
|-----|------------|------------|-----------|
| 2.8 | High       | 50         | High 38   |
| 4   | High       | 56         | High 46   |
| 5.6 | High       | 64         | High 51   |
| 8   | High       | 61         | High 50   |
| 11  | High       | 58         | High 47   |
| 16  | High       | 51         | High 41   |
| 22  | Medium     | 46         | Medium 35 |



## Interchangeable Lenses

### PERFORMANCE

| Our Standard                                                                                                    | as Tested                          |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length:</b> ±5%<br>(33.25-36.75mm)<br>(99.75-110.25mm)                                                 | 36.60mm<br>103.70mm                |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 105mm: (f/4.28-4.73)                                                | f/3.50<br>f/4.73                   |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>105mm: (±2.5%)                                                           | 0.46% (pincshn)<br>1.42% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>105mm: (0-1.1 stops) | 0.7 stops<br>0.4 stops             |

### RESOLUTION

| MAXXUM AF 35-105mm f/3.5-4.5<br>at 35mm/1:50 |                      |                      |           |    |
|----------------------------------------------|----------------------|----------------------|-----------|----|
| f/                                           | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 3.5                                          | Excellent            | 56                   | Excellent | 50 |
| 5.6                                          | Excellent            | 56                   | Excellent | 50 |
| 8                                            | Excellent            | 63                   | Excellent | 56 |
| 11                                           | Excellent            | 70                   | Excellent | 63 |
| 16                                           | Excellent            | 63                   | Excellent | 56 |
| 22                                           | Excellent            | 56                   | Excellent | 50 |

### CONTRAST

| MAXXUM AF 35-105mm f/3.5-4.5<br>at 35mm<br>at 30 lines/mm |            |            |        |    |
|-----------------------------------------------------------|------------|------------|--------|----|
| f/                                                        | Center (%) | Corner (%) |        |    |
| 3.5                                                       | High       | 51         | High   | 39 |
| 5.6                                                       | High       | 64         | High   | 44 |
| 8                                                         | High       | 67         | High   | 51 |
| 11                                                        | High       | 58         | High   | 48 |
| 16                                                        | High       | 56         | High   | 42 |
| 22                                                        | Medium     | 40         | Medium | 33 |

### RESOLUTION

| MAXXUM AF 35-105mm f/3.5-4.5<br>at 50mm/1:50 |                      |                      |           |    |
|----------------------------------------------|----------------------|----------------------|-----------|----|
| f/                                           | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 4                                            | Excellent            | 56                   | Excellent | 50 |
| 5.6                                          | Excellent            | 56                   | Excellent | 50 |
| 8                                            | Excellent            | 63                   | Excellent | 56 |
| 11                                           | Excellent            | 70                   | Excellent | 63 |
| 16                                           | Excellent            | 63                   | Excellent | 56 |
| 22                                           | Excellent            | 56                   | Excellent | 50 |

### CONTRAST

| MAXXUM AF 35-105mm f/3.5-4.5<br>at 50mm<br>at 30 lines/mm |            |            |        |    |
|-----------------------------------------------------------|------------|------------|--------|----|
| f/                                                        | Center (%) | Corner (%) |        |    |
| 4                                                         | High       | 55         | High   | 36 |
| 5.6                                                       | High       | 68         | High   | 40 |
| 8                                                         | High       | 69         | High   | 52 |
| 11                                                        | High       | 51         | High   | 45 |
| 16                                                        | Medium     | 45         | Medium | 35 |
| 22                                                        | Low        | 39         | Low    | 30 |

### MACRO RESOLUTION

| MAXXUM AF 35-105mm f/3.5-4.5<br>at 105mm/1:3.97 |                      |                      |         |    |
|-------------------------------------------------|----------------------|----------------------|---------|----|
| f/                                              | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |         |    |
| 4.5                                             | Good                 | 40                   | Good    | 28 |
| 5.6                                             | Good                 | 45                   | V. Good | 32 |
| 8                                               | Good                 | 50                   | V. Good | 36 |
| 11                                              | V. Good              | 50                   | V. Good | 36 |
| 16                                              | Good                 | 45                   | Good    | 32 |
| 22                                              | Accept               | 40                   | Good    | 32 |

### RESOLUTION

| MAXXUM AF 35-105mm f/3.5-4.5<br>at 105mm/1:50 |                      |                      |           |    |
|-----------------------------------------------|----------------------|----------------------|-----------|----|
| f/                                            | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 4.5                                           | Excellent            | 56                   | Excellent | 50 |
| 5.6                                           | Excellent            | 63                   | Excellent | 56 |
| 8                                             | Excellent            | 70                   | Excellent | 63 |
| 11                                            | Excellent            | 63                   | Excellent | 56 |
| 16                                            | Excellent            | 56                   | Excellent | 50 |
| 22                                            | Excellent            | 50                   | Excellent | 45 |

### CONTRAST

| MAXXUM AF 35-105mm f/3.5-4.5<br>at 105mm<br>at 30 lines/mm |            |            |        |    |
|------------------------------------------------------------|------------|------------|--------|----|
| f/                                                         | Center (%) | Corner (%) |        |    |
| 4.5                                                        | High       | 57         | High   | 38 |
| 5.6                                                        | High       | 59         | High   | 42 |
| 8                                                          | High       | 64         | High   | 51 |
| 11                                                         | High       | 50         | High   | 45 |
| 16                                                         | High       | 41         | High   | 38 |
| 22                                                         | Medium     | 38         | Medium | 31 |

slight over-corrected spherical aberration and very slight chromatic aberration at maximum aperture. Both disappeared by f/11 and the image was near diffraction limits by f/16. Off axis at f/2.8 we noted slight skew-ray flare mixed with very slight astigmatism. Aberrations were almost gone by f/8. Minimal lateral color.

At 35mm, on axis, the 35-105mm showed slight over-corrected spherical aberration mixed with very slight chromatic aberration. The image was diffraction limited by f/11. Off axis, slight skew-ray flare mixed with slight coma. Slight lateral color was also present.

At the 50mm setting we saw slight over-corrected spherical aberration and very slight axial astigmatism. Again, the image was diffraction limited by f/11. Off axis, slight skew-ray flare mixed with very slight astigmatism. Slight lateral color present.

At 105mm, on axis, we found slight over-corrected spherical aberration and very slight yellow flare. The image reached its diffraction limit by f/11. Off axis, image quality was the same as at the 50mm setting. (March 1986)

## WIDE, MEDIUM TELE ZOOMS FROM MINOLTA

**Specifications:** 35-70mm f/3.5 Minolta MD in Minolta bayonet mount; No. 1032403; accepts 55mm screw-in filters; f/3.5 to f/22 with full-stop detents, half stops between f/5.6 and f/16; min. foc. dist. 2.8 ft. (0.8m); 2 3/4 in. long, 2 1/2 in. diam. (70 × 66mm); 13 oz. (364g); \$157.50

**Specifications:** 50-135mm f/3.5 Minolta MD in Minolta bayonet mount; No. 8005426; accepts 55mm screw-in filters; f/3.5 to f/32 with full stop detents, half stops between f/5.6 and f/22; min. foc. dist. 5 ft. (1.5m); 4 3/4 in. long, 2 1/2 in. diam. (120 × 63mm); 17 oz. (476g); \$226.

**Practical comments:** Both lenses have large, clear, well-defined white-on-black focal length and aperture scales, yellow (feet) and white (meters) distance scales. 35-70mm lens has: separate zooming and focusing controls; 1-in. rubberized, studded focusing ring, 1/2-in. ribbed zoom ring; smooth

focus control with continuous focus from infinity to minimum setting in 100°; smooth, swift zooming control, but position of macro mode lock button on ring makes accidental release possible, causing inadvertent entry into macro mode when zooming toward 70mm range; positive lock prevents accidental entry into normal mode when in macro. 50-135mm lens has: combined zooming and focusing controls; 2-in. rubberized, studded control ring; smooth, positive focus/zoom control with continuous focus from infinity to minimum setting in 150°; slightly stiff control ring makes for positive hold at all settings; ring does not move when lens is vertical.

**Field test slides:** 35-70mm lens: Slightly soft image quality in corners at 35mm focal length at maximum aperture. Quality improves by f/5.6 with overall sharp image and snappy detail by f/8. At 50mm, corners become sharp by f/8; at 70mm, corners as sharp as center at all apertures. Flare well controlled throughout. Very small hint of pincushion distortion at 70mm, barrel distortion apparent at 35mm. Slides taken in closest macro setting were better at apertures wider than f/11.

50-135mm lens: Flare well controlled throughout. Barrel distortion noted at 50mm focal length; pincushion distortion present at 135mm. Light falloff observed at maximum aperture at 135mm setting. Image quality consistent overall at 50mm but sharpness improves by f/8. Similar performance at 80mm and 135mm but sharpness improves by f/5.6. Average overall performance for lens of this type.

**Optical bench analysis:** (for optical experts only): 35-70mm lens: At 35mm, on axis—primary chromatic aberration, near theoretical diffraction limit by f/8. Off axis—very slight skew-ray flare mixed with astigmatism noted. Lateral color present throughout.

At 50mm, on axis—very slight yellow flare present. Primary chromatic aberration, near theoretical diffraction limit by f/8. Off axis—slight skew-ray flare mixed with astigmatism present. Lateral color noted throughout.

At 70mm, on axis—very slight yellow flare noted. Primary chromatic aberration, near theoretical diffraction limit by f/8. Off axis—slight skew-ray flare mixed with slight astigmatism observed. Lateral color present throughout.

50-135mm lens: at 50mm, on axis—very slight yellow flare noted. Over-corrected spherical aberration present, near theoretical diffraction limit by f/8. Off axis—slight skew-ray flare mixed with slight astigmatism noted. Lateral color present throughout.

At 80mm, on axis—slight yellow flare present. Over-corrected spherical aberration noted, near theoretical diffraction limit by

### PERFORMANCE

| Our Standard                                                                                                   | as Tested                          |
|----------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length:</b> ±5%<br>(33.25-36.75mm)<br>(66.50-73.50mm)                                                 | 36.60mm<br>68.63mm                 |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 70mm: (f/3.33-3.68)                                                | f/3.61<br>f/3.68                   |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>70mm: (±2%)                                                             | 2.2% (barrel)<br>1.4% (pincushion) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>70mm: (0-1.3 stops) | 0.9 stops<br>0.7 stops             |



## Interchangeable Lenses

### RESOLUTION

| MINOLTA 35-70mm f/3.5<br>at 35mm<br>at 1: 50 |                  |    |                  |    |
|----------------------------------------------|------------------|----|------------------|----|
| f/                                           | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                          | Excellent        | 56 | Excellent        | 45 |
| 5.6                                          | Excellent        | 63 | Excellent        | 50 |
| 8                                            | Excellent        | 63 | Excellent        | 50 |
| 11                                           | Excellent        | 63 | Excellent        | 56 |
| 16                                           | Excellent        | 56 | Excellent        | 50 |
| 22                                           | Excellent        | 50 | Excellent        | 45 |

### CONTRAST

| MINOLTA 35-70mm f/3.5<br>at 35mm<br>at 30 lines/mm |               |    |               |    |
|----------------------------------------------------|---------------|----|---------------|----|
| f/                                                 | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                                | High          | 50 | High          | 42 |
| 5.6                                                | High          | 57 | High          | 48 |
| 8                                                  | High          | 60 | High          | 49 |
| 11                                                 | High          | 56 | High          | 50 |
| 16                                                 | High          | 51 | High          | 44 |
| 22                                                 | Medium        | 43 | High          | 40 |

### RESOLUTION

| MINOLTA 35-70mm f/3.5<br>at 50mm<br>at 1: 50 |                  |    |                  |    |
|----------------------------------------------|------------------|----|------------------|----|
| f/                                           | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                          | Excellent        | 56 | Excellent        | 50 |
| 5.6                                          | Excellent        | 63 | Excellent        | 50 |
| 8                                            | Excellent        | 63 | Excellent        | 50 |
| 11                                           | Excellent        | 56 | Excellent        | 50 |
| 16                                           | Excellent        | 56 | Excellent        | 50 |
| 22                                           | V. Good          | 50 | Excellent        | 45 |

### CONTRAST

| MINOLTA 35-70mm f/3.5<br>at 50mm<br>at 30 lines/mm |               |    |               |    |
|----------------------------------------------------|---------------|----|---------------|----|
| f/                                                 | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                                | High          | 49 | High          | 40 |
| 5.6                                                | High          | 57 | High          | 46 |
| 8                                                  | High          | 63 | High          | 48 |
| 11                                                 | High          | 61 | High          | 44 |
| 16                                                 | High          | 52 | High          | 43 |
| 22                                                 | High          | 50 | High          | 40 |

### RESOLUTION

| MINOLTA 35-70mm f/3.5<br>at 70mm<br>at 1:50 |                  |    |                  |    |
|---------------------------------------------|------------------|----|------------------|----|
| f/                                          | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                         | Excellent        | 56 | Excellent        | 45 |
| 5.6                                         | Excellent        | 63 | Excellent        | 50 |
| 8                                           | Excellent        | 63 | Excellent        | 50 |
| 11                                          | Excellent        | 63 | Excellent        | 50 |
| 16                                          | Excellent        | 56 | Excellent        | 50 |
| 22                                          | V. Good          | 50 | Excellent        | 45 |

### CONTRAST

| MINOLTA 35-70mm f/3.5<br>at 70mm<br>at 30 lines/mm. |               |    |               |    |
|-----------------------------------------------------|---------------|----|---------------|----|
| f/                                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                                 | High          | 50 | High          | 47 |
| 5.6                                                 | High          | 62 | High          | 58 |
| 8                                                   | High          | 70 | High          | 65 |
| 11                                                  | High          | 66 | High          | 60 |
| 16                                                  | High          | 55 | High          | 58 |
| 22                                                  | High          | 50 | High          | 50 |

f/11. Off axis—slight skew-ray flare and slight coma observed. Lateral color noted.

At 135mm, on axis—slight yellow flare noted. Secondary chromatic aberration observed, near theoretical diffraction limit by f/8. Off axis—very slight coma mixed with astigmatism present. Lateral color observed throughout. (August 1984)

### PERFORMANCE

| Our Standard                                                   |  | as Tested                         |  |
|----------------------------------------------------------------|--|-----------------------------------|--|
| Focal length: $\pm 5\%$<br>(47.50-52.50mm)                     |  | 51.85mm<br>132.68mm               |  |
| Aperture: $\pm 5\%$<br>(f/3.33-3.68)                           |  | f/3.61<br>f/3.65                  |  |
| Distortion:<br>50mm: ( $\pm 1.5\%$ )<br>135mm: ( $\pm 2.5\%$ ) |  | 1.36% (barrel)<br>2.3% (pincush.) |  |
| Light falloff: at f/5.6<br>+1 stop from theoretical limit      |  | 0.8 stops                         |  |
| 50mm: (0-1.5 stops)<br>135mm: (0-1.1 stops)                    |  | 0.8 stops                         |  |

### RESOLUTION

| MINOLTA 50-135mm f/3.5<br>at 50mm<br>at 1:50 |                  |    |                  |    |
|----------------------------------------------|------------------|----|------------------|----|
| f/                                           | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                          | Excellent        | 50 | Excellent        | 45 |
| 5.6                                          | V. Good          | 50 | Excellent        | 45 |
| 8                                            | Excellent        | 56 | Excellent        | 50 |
| 11                                           | Excellent        | 56 | Excellent        | 56 |
| 16                                           | Excellent        | 63 | Excellent        | 56 |
| 22                                           | Excellent        | 56 | Excellent        | 45 |
| 32                                           | V. Good          | 45 | Excellent        | 45 |

### CONTRAST

| MINOLTA 50-135mm f/3.5<br>at 50mm<br>at 30 lines/mm |               |    |               |    |
|-----------------------------------------------------|---------------|----|---------------|----|
| f/                                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                                 | High          | 51 | High          | 33 |
| 5.6                                                 | High          | 53 | High          | 39 |
| 8                                                   | High          | 55 | High          | 44 |
| 11                                                  | High          | 49 | High          | 43 |
| 16                                                  | Medium        | 42 | Medium        | 38 |
| 22                                                  | Medium        | 41 | Medium        | 34 |
| 32                                                  | Medium        | 35 | Medium        | 32 |

### RESOLUTION

| MINOLTA 50-135mm f/3.5<br>at 80mm<br>at 1:50 |                  |    |                  |    |
|----------------------------------------------|------------------|----|------------------|----|
| f/                                           | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                          | Excellent        | 56 | Excellent        | 45 |
| 5.6                                          | Excellent        | 63 | Excellent        | 50 |
| 8                                            | Excellent        | 70 | Excellent        | 56 |
| 11                                           | Excellent        | 63 | Excellent        | 50 |
| 16                                           | Excellent        | 56 | Excellent        | 50 |
| 22                                           | V. Good          | 50 | Excellent        | 50 |
| 32                                           | V. Good          | 45 | Excellent        | 40 |

### CONTRAST

| MINOLTA 50-135mm f/3.5<br>at 80mm<br>at 30 lines/mm |               |    |               |    |
|-----------------------------------------------------|---------------|----|---------------|----|
| f/                                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                                 | High          | 48 | High          | 34 |
| 5.6                                                 | High          | 53 | High          | 40 |
| 8                                                   | High          | 56 | High          | 48 |
| 11                                                  | High          | 63 | High          | 58 |
| 16                                                  | High          | 57 | High          | 55 |
| 22                                                  | High          | 55 | High          | 54 |
| 32                                                  | High          | 45 | High          | 40 |

### RESOLUTION

| MINOLTA 50-135mm f/3.5<br>at 135mm<br>at 1:51 |                  |    |                  |    |
|-----------------------------------------------|------------------|----|------------------|----|
| f/                                            | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                           | Excellent        | 51 | Excellent        | 45 |
| 5.6                                           | Excellent        | 57 | Excellent        | 51 |
| 8                                             | Excellent        | 64 | Excellent        | 51 |
| 11                                            | Excellent        | 64 | Excellent        | 51 |
| 16                                            | Excellent        | 64 | Excellent        | 51 |
| 22                                            | Excellent        | 57 | Excellent        | 45 |
| 32                                            | V. Good          | 45 | Excellent        | 40 |

### CONTRAST

| MINOLTA 50-135mm f/3.5<br>at 135mm<br>at 30 lines/mm |               |    |               |    |
|------------------------------------------------------|---------------|----|---------------|----|
| f/                                                   | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                                  | High          | 50 | High          | 33 |
| 5.6                                                  | High          | 54 | High          | 39 |
| 8                                                    | High          | 60 | High          | 44 |
| 11                                                   | High          | 58 | High          | 43 |
| 16                                                   | High          | 56 | High          | 39 |
| 22                                                   | High          | 55 | High          | 38 |
| 32                                                   | High          | 46 | High          | 33 |

## CHOICE OF TWO 24mm LENSES FROM NIKON

**Specifications:** 24mm f/2 Nikkor, No. 203485 in Nikon AI mount, accepts 52mm accessories; f/2 to f/22 with full stop detents; min. foc. dist. 11¼ in. (0.3m); 2 in. long, 2½ in. diam. (63 x 51mm), 10½ oz. (300g), \$485.

**Specifications:** 24mm f/2.8 Nikkor, No. 723796 in Nikon AI mount, accepts 52mm accessories; f/2.8 to f/22 within full stop detents; min. foc. dist. 11¼ in. (0.3m); 1¾ in. long, 2½ in. diam. (47 x 63mm), 9½ oz. (250g), \$313.

**Practical comments:** Herewith a test of two well known lenses undertaken to catch up with the basic optics of the major lens manufacturers. Both lenses have ½ in. wide, triple tier, studded, rubberized focusing mounts having extremely smooth action. Aperture numeral size is large but distances are just adequate, although well engraved. Both the 11 element 10 group 24mm f/2 and 9 element 9 group 24mm f/2.8 are constructed in the usual rugged Nikon manner.

**Field test slides:** Transparencies shot with the 24mm f/2 exhibited crisp, sharp definition in the center of the field at all apertures. The corners of the image were slightly soft at f/2, improved slightly at f/2.8 were on a par with central definition by f/4. Some color fringing barely noticeable in the extreme corners of the frame but flare very well controlled

### PERFORMANCE

| Our Standard                                              |  | as Tested             |  |
|-----------------------------------------------------------|--|-----------------------|--|
| Focal length: $\pm 5\%$<br>(22.80-25.20mm)                |  | 24.71mm               |  |
| Aperture: $\pm 5\%$<br>(f/1.90-2.10)                      |  | f/2.04                |  |
| Distortion:<br>( $\pm 4\%$ )                              |  | less than 1% (barrel) |  |
| Light Falloff: at f/5.6<br>+1 stop from theoretical limit |  | 1.2 stops             |  |
| 0-3.0 stops                                               |  |                       |  |



## Interchangeable Lenses

### RESOLUTION

| Nikkor 24mm f/2<br>at 1:47.2 |                  |    |                  |    |
|------------------------------|------------------|----|------------------|----|
| f/                           | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 2                            | Excellent        | 53 | V. Good          | 30 |
| 2.8                          | Excellent        | 59 | V. Good          | 33 |
| 4                            | Excellent        | 67 | V. Good          | 37 |
| 5.6                          | Excellent        | 75 | Excellent        | 42 |
| 8                            | Excellent        | 75 | Excellent        | 42 |
| 11                           | Excellent        | 67 | Excellent        | 42 |
| 16                           | Excellent        | 59 | V. Good          | 37 |
| 22                           | V. Good          | 53 | V. Good          | 37 |

### CONTRAST

| Nikkor 24mm f/2<br>at 30 lines/mm |               |    |               |    |
|-----------------------------------|---------------|----|---------------|----|
| f/                                | Center<br>(%) |    | Corner<br>(%) |    |
| 2                                 | High          | 48 | High          | 43 |
| 2.8                               | High          | 56 | High          | 48 |
| 4                                 | High          | 60 | High          | 48 |
| 5.6                               | High          | 76 | High          | 47 |
| 8                                 | High          | 76 | Medium        | 40 |
| 11                                | High          | 72 | Medium        | 38 |
| 16                                | High          | 64 | Medium        | 32 |
| 22                                | High          | 54 | Low           | 30 |

throughout. Overall, superior performance for a very high speed 24mm lens.

The on-film performance of the 24mm f/2.8 closely paralleled the 24mm f/2, with crisp, sharp, central definition at all apertures and slight softness in the corners of the frame at f/2.8, improving noticeably by f/4. Lateral color just noticeable in extreme corners; flare very well controlled throughout. Much better than average performance for a lens of this type.

### PERFORMANCE

| Our Standard                                                               |  | as Tested      |  |
|----------------------------------------------------------------------------|--|----------------|--|
| Focal length: $\pm 5\%$<br>(22.80-25.20mm)                                 |  | 24.52mm        |  |
| Aperture: $\pm 5\%$<br>(f/2.66-2.94)                                       |  | f/2.90         |  |
| Distortion:<br>( $\pm 4\%$ )                                               |  | 1.11% (barrel) |  |
| Light falloff: at f/5.6<br>+1 stop from theoretical limit<br>(0-3.0 stops) |  | 1.4 stops      |  |

### RESOLUTION

| Nikkor 24mm f/2.8<br>at 1:47.2 |                  |    |                  |    |
|--------------------------------|------------------|----|------------------|----|
| f/                             | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 2.8                            | Excellent        | 59 | Excellent        | 37 |
| 4                              | Excellent        | 59 | Excellent        | 37 |
| 5.6                            | Excellent        | 67 | Excellent        | 42 |
| 8                              | Excellent        | 67 | Excellent        | 47 |
| 11                             | Excellent        | 59 | Excellent        | 47 |
| 16                             | V. Good          | 53 | Excellent        | 42 |
| 22                             | Good             | 47 | V. Good          | 37 |

### CONTRAST

| Nikkor 24mm f/2.8<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------|---------------|----|---------------|----|
| f/                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 2.8                                 | High          | 70 | High          | 48 |
| 4                                   | High          | 74 | High          | 56 |
| 5.6                                 | High          | 76 | High          | 56 |
| 8                                   | High          | 74 | High          | 44 |
| 11                                  | High          | 74 | High          | 44 |
| 16                                  | High          | 60 | High          | 40 |
| 22                                  | High          | 50 | Medium        | 35 |

**Optical bench report** (for optical experts only): The 24mm f/2 exhibited slight zonal spherical aberration and moderate undercorrected spherical aberration on axis at maximum aperture, but these defects were virtually eliminated by f/5.6, at which point image quality was judged excellent. Off axis, we observed moderate skew-ray flare, and very slight lateral color at the widest apertures, but astigmatism was absent and image quality improved to good at f/8 and smaller apertures.

The 24mm f/2.8 yielded slight zonal spherical aberration and slight red flare on axis at the widest apertures, but image quality was excellent by f/5.6. Off axis we observed slight coma, very slight lateral color, and slight astigmatism, but stopping down to f/8 eliminated virtually all these defects and image quality improved to very good. (March 1984)

## QUICK 28mm f/2.8 AF NIKKOR LENS

**Specifications:** 28mm f/2.8 AF Nikkor No.205092 in Nikkor autofocus mount, accepts 52mm accessories; f/2.8-22 in half-stop increments; min. foc. dist.: 1 foot (0.3m). \$234.99.

**Comments:** Autofocuses quickly and quietly through entire distance range; focuses smoothly in manual mode in one 90-degree turn. Smooth, well-finished, non-textured surface; knurled aperture ring features minimum aperture lock with bright green aperture scale numbers.

**Field test slides:** Slides were crisp and snappy with detail well rendered. Wide open, corners were slightly soft, but corners equalled center sharpness by f/5.6. Slight barrel distortion. Flare well controlled. An above-average lens.

**Optical bench analysis:** On-axis, very slight overcorrected spherical aberration,

### PERFORMANCE

| Our Standard                                                               |  | As Tested      |  |
|----------------------------------------------------------------------------|--|----------------|--|
| Focal length: $\pm 5\%$<br>(26.60-29.40mm)                                 |  | 29.28mm        |  |
| Aperture: $\pm 5\%$<br>(f/2.66-2.94)                                       |  | f/2.86         |  |
| Distortion:<br>( $\pm 2.5\%$ )                                             |  | 0.90% (barrel) |  |
| Light falloff: at f/5.6<br>+1 stop from theoretical limit<br>(0-2.0 stops) |  | 0.5 stops      |  |

### RESOLUTION

| NIKKOR AF 28mm f/2.8<br>at 1:49 |               |    |               |    |
|---------------------------------|---------------|----|---------------|----|
| f/                              | Center (1/mm) |    | Corner (1/mm) |    |
| 2.8                             | V. Good       | 55 | Excellent     | 44 |
| 4                               | Excellent     | 62 | Excellent     | 49 |
| 5.6                             | V. Good       | 62 | Excellent     | 55 |
| 8                               | Excellent     | 69 | Excellent     | 62 |
| 11                              | Excellent     | 62 | Excellent     | 55 |
| 16                              | V. Good       | 55 | Excellent     | 49 |
| 22                              | Good          | 49 | V. Good       | 44 |

### CONTRAST

| at 30 lines/mm |            |    |            |    |
|----------------|------------|----|------------|----|
| f/             | Center (%) |    | Corner (%) |    |
| 2.8            | High       | 54 | High       | 40 |
| 4              | High       | 58 | High       | 41 |
| 5.6            | High       | 62 | High       | 50 |
| 8              | High       | 63 | High       | 51 |
| 11             | High       | 58 | High       | 45 |
| 16             | High       | 47 | Medium     | 39 |
| 22             | Low        | 35 | Low        | 29 |

with very slight red flare, gone by f/4. Diffraction limited by f/11. Off-axis, very slight skew-ray flare mixed with very slight astigmatism, almost gone by f/16. Lateral color present.

## SUPER-SPEED WIDE-ANGLE NIKKOR: 35mm f/1.4 IN AIS MOUNT

**Specifications:** 35mm f/1.4 Nikkor, Nikon AIS mount; No. 438160; multicoated; accepts 52mm filters; f/1.4 to f/16; whole stop detents; min foc. dist.: 1 ft. (0.3m); 2 $\frac{1}{16}$  in. long, 2 $\frac{1}{16}$  in. diam. (62.5 x 67.5mm) 14 $\frac{1}{8}$  oz. (400g); \$550.00.

**Practical comments:** Balances very nicely on Nikon SLRs; very grippable  $\frac{1}{16}$ -in.-wide focusing collar focuses counterclockwise to minimum distance very smoothly in just-over  $\frac{1}{4}$  turn, holds settings well; small but well engraved white-on-black metric distance and

### PERFORMANCE

| Our Standard                                                               |  | as Tested         |  |
|----------------------------------------------------------------------------|--|-------------------|--|
| Focal length: $\pm 5\%$<br>(33.25-36.75mm)                                 |  | 36.60mm           |  |
| Aperture: $\pm 5\%$<br>(f/1.33-1.47)                                       |  | f/1.44            |  |
| Distortion:<br>( $\pm 2.5\%$ )                                             |  | under 1% (barrel) |  |
| Light falloff: at f/5.6<br>+1 stop from theoretical limit<br>(0-1.9 stops) |  | 0.2 stops         |  |

### RESOLUTION

| NIKKOR 35mm f/1.4<br>at 1: 49.01 |                  |    |                  |    |
|----------------------------------|------------------|----|------------------|----|
| f/                               | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 1.4                              | Excellent        | 62 | Excellent        | 39 |
| 2                                | Excellent        | 69 | Excellent        | 44 |
| 2.8                              | Excellent        | 78 | Excellent        | 44 |
| 4                                | Excellent        | 78 | Excellent        | 44 |
| 5.6                              | Excellent        | 78 | Excellent        | 44 |
| 8                                | Excellent        | 87 | Excellent        | 49 |
| 11                               | Excellent        | 69 | Excellent        | 49 |
| 16                               | Excellent        | 62 | Excellent        | 44 |

### CONTRAST

| NIKKOR 35mm f/1.4<br>at 30 lines/mm |               |    |               |    |
|-------------------------------------|---------------|----|---------------|----|
| f/                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 1.4                                 | High          | 64 | Medium        | 26 |
| 2                                   | High          | 64 | Medium        | 27 |
| 2.8                                 | High          | 68 | Medium        | 40 |
| 4                                   | High          | 74 | High          | 46 |
| 5.6                                 | High          | 72 | High          | 50 |
| 8                                   | High          | 78 | High          | 46 |
| 11                                  | High          | 74 | Medium        | 40 |
| 16                                  | High          | 68 | Medium        | 34 |

yellow-on-black footage scales;  $\frac{3}{16}$ -in.-wide aperture ring at rear well differentiated by feel with, smooth predictable action; legible color-coded apertures keyed to colored depth-of-field scale; red infrared focus index dot; fine quality semi-gloss black laquer finish; as expected, extremely bright and contrasty focusing image.

**Field test slides:** Flare very well controlled. Transparencies crisp and snappy at center and edge at all apertures, with barely detectable increase in sharpness at f/2 on down. Well above average performance at all apertures.

**Optical bench report** (for optical experts only): On axis, slight flare at widest apertures virtually eliminated by f/5.6; point image pat-



tern near diffraction limit by f/8; image quality holds at smaller apertures. Off axis, slight skew-ray flare gone by f/5.6, slight lateral color throughout. (August 1984)

## NEW 28-85mm AF NIKKOR LENS

**Specifications:** 28–85mm f/3.5–4.5 AF Nikkor No.202353, accepts 62mm accessories; full-stop detents from 3.5 (4.5 at 85mm) to 22, with lock for automatic operation; min. foc. dist.: 3 feet (0.8m), 9 inches in macro; macro reproduction ratio 1:3.4. 3 9/16 inches long, 3 3/16 inches diameter, 1 pound 9 ounces (507g). \$430.

**Comments:** Positive zoom ring grip with smooth, comfortable zooming action throughout range of focal lengths; in manual focusing mode, the rather thin outer ring is difficult to grasp with any positive feel, and we recommend focusing by sliding your index finger back and forth beneath the ring rather than trying for a thumb-and-index-finger grip. Focusing scales in white numerals are clearly inset beneath a plastic window on top of the lens barrel. However, they can be a bit difficult to read, due to reflection and glare, under certain specific lighting conditions. Convenient positive lock button prevents your accidentally slipping into macro mode; a distinct click signals that you are out of macro operation.

**Field test slides:** Our test slides were

### PERFORMANCE

| Our Standard                                                                                                   | As Tested                         |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Focal length:</b> ±5%<br>(26.60–29.40mm)<br>(80.75–89.25mm)                                                 | 29.28mm<br>83.27mm                |
| <b>Aperture:</b> ±5%<br>(f/3.33–3.68)<br>at 85mm: (f/4.28–4.73)                                                | f/3.58<br>f/4.63                  |
| <b>Distortion:</b><br>28mm: (±2.5%)<br>85mm: (±2%)                                                             | 1.33% (barrel)<br>1.86% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>28mm: (0–2.0 stops)<br>85mm: (0–1.2 stops) | 0.6 stops<br>0.4 stops            |

### RESOLUTION

| NIKKOR AF 28–85mm f/3.5–4.5 at 28mm/1:4.9 |               |               |           |    |
|-------------------------------------------|---------------|---------------|-----------|----|
| f/                                        | Center (l/mm) | Corner (l/mm) |           |    |
| 3.5                                       | V. Good       | 49            | Excellent | 44 |
| 5.6                                       | Excellent     | 55            | Excellent | 49 |
| 8                                         | V. Good       | 55            | Excellent | 49 |
| 11                                        | Excellent     | 62            | Excellent | 55 |
| 16                                        | Excellent     | 55            | Excellent | 49 |
| 22                                        | V. Good       | 49            | Excellent | 44 |

### at 50mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |           |    |
|-----|---------------|---------------|-----------|----|
| 4   | Excellent     | 50            | Excellent | 45 |
| 5.6 | Excellent     | 56            | Excellent | 50 |
| 8   | Excellent     | 63            | Excellent | 56 |
| 11  | Excellent     | 56            | Excellent | 50 |
| 16  | V. Good       | 50            | Excellent | 45 |
| 22  | Good          | 45            | V. Good   | 40 |

### at 85mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |           |    |
|-----|---------------|---------------|-----------|----|
| 4.5 | Excellent     | 50            | Excellent | 45 |
| 5.6 | Excellent     | 56            | Excellent | 50 |
| 8   | Excellent     | 56            | Excellent | 56 |
| 11  | Excellent     | 56            | Excellent | 50 |
| 16  | V. Good       | 50            | Excellent | 45 |
| 22  | Good          | 45            | Excellent | 40 |

crisp and snappy with well-rendered detail. At 28mm, corners slightly soft wide open, improved by f/8. Very slight pincushion noted. Macro quality average. Flare well controlled. Overall, an above-average lens for this type.

**Optical bench analysis:** At 28mm, on-axis, very slight overcorrected spherical aberration, very slight red flare gone by f/5.6; diffraction limited by f/16. Off-axis, very slight coma mixed with very slight astigmatism gone by f/16. Lateral color present.

At 50mm, on-axis, very slight overcorrected spherical aberration, very slight flare gone by two stops. Diffraction limited by f/16. Off-axis, very slight skew-ray flare mixed with very slight astigmatism; lateral color present.

At 85mm, on-axis, very slight overcorrected spherical aberration, very slight red/yellow flare gone by f/8. Diffraction limited by f/16. Off-axis, very slight coma mixed with slight astigmatism gone by f/16. Lateral color present.

### MACRO RESOLUTION

| at 85mm/1:4 |               |               |           |    |
|-------------|---------------|---------------|-----------|----|
| f/          | Center (l/mm) | Corner (l/mm) |           |    |
| 4.5         | Accept        | 36            | Excellent | 32 |
| 5.6         | Accept        | 40            | Excellent | 36 |
| 8           | Good          | 51            | Excellent | 45 |
| 11          | Excellent     | 57            | Excellent | 51 |
| 16          | V. Good       | 51            | Excellent | 45 |
| 22          | Good          | 45            | Excellent | 40 |

### CONTRAST

| at 28mm/30 lines/mm |            |            |        |    |
|---------------------|------------|------------|--------|----|
| f/                  | Center (%) | Corner (%) |        |    |
| 3.5                 | Medium     | 31         | Low    | 21 |
| 5.6                 | Medium     | 42         | High   | 34 |
| 8                   | Medium     | 47         | Medium | 35 |
| 11                  | High       | 44         | Medium | 30 |
| 16                  | Medium     | 39         | Low    | 29 |
| 22                  | Low        | 30         | Low    | 24 |

### at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%) |        |    |
|-----|------------|------------|--------|----|
| 4   | Medium     | 36         | Medium | 25 |
| 5.6 | Medium     | 46         | High   | 36 |
| 8   | Medium     | 50         | Medium | 38 |
| 11  | Medium     | 42         | Low    | 30 |
| 16  | Low        | 39         | Low    | 29 |
| 22  | V. Low     | 30         | Low    | 24 |

### at 85mm/30 lines/mm

| f/  | Center (%) | Corner (%) |        |    |
|-----|------------|------------|--------|----|
| 4.5 | Medium     | 37         | Medium | 26 |
| 5.6 | High       | 50         | High   | 36 |
| 8   | High       | 57         | High   | 46 |
| 11  | High       | 49         | High   | 38 |
| 16  | High       | 41         | Medium | 31 |
| 22  | Low        | 31         | V. Low | 21 |

## LIGHT AND FAST 180mm NIKKOR

**Specifications:** 180mm f/2.8 Nikkor ED, no. 410563, in Nikon AI mount; accepts 72mm filters; f/2.8 to f/32, detents at 1-stop intervals; min. foc. dist. 6 ft. (1.8m); 5 1/8 in. long, 3 in. diameter (130 x 79mm); 1 lb. 12 oz. (800g). \$730.00.

**Practical comments:** Surprisingly light and compact feel for lens of this type, attributable to Nikon ED (Extra-low Dispersion) glass; balances well with camera when motor or winder is attached. Easily gripped, 1 1/4 in. knurled color focuses from 6 ft. to infinity in

## Interchangeable Lenses

### PERFORMANCE

| Our Standard                                                                      | as Tested          |
|-----------------------------------------------------------------------------------|--------------------|
| <b>Focal length:</b> ±5%<br>(171.00–189.00mm)                                     | 181.02mm           |
| <b>Aperture:</b> ±5%<br>(f/2.66–2.94)                                             | f/2.83             |
| <b>Distortion:</b><br>(±2.5%)                                                     | under 1% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0–1.0 stops) | 0.3 stops          |

### RESOLUTION

| NIKKOR-ED 180mm f/2.8 at 1:50 |               |               |           |    |
|-------------------------------|---------------|---------------|-----------|----|
| f/                            | Center (l/mm) | Corner (l/mm) |           |    |
| 2.8                           | Excellent     | 50            | Excellent | 45 |
| 4                             | Excellent     | 56            | Excellent | 50 |
| 5.6                           | Excellent     | 56            | Excellent | 50 |
| 8                             | Excellent     | 63            | Excellent | 56 |
| 11                            | Excellent     | 63            | Excellent | 56 |
| 16                            | Excellent     | 56            | Excellent | 50 |
| 22                            | Excellent     | 50            | Excellent | 50 |
| 32                            | Excellent     | 50            | Excellent | 45 |

### CONTRAST

| NIKKOR-ED 180mm f/2.8 at 30 lines/mm |            |            |        |    |
|--------------------------------------|------------|------------|--------|----|
| f/                                   | Center (%) | Corner (%) |        |    |
| 2.8                                  | High       | 44         | High   | 40 |
| 4                                    | High       | 50         | High   | 42 |
| 5.6                                  | High       | 57         | High   | 46 |
| 8                                    | High       | 60         | High   | 50 |
| 11                                   | High       | 56         | High   | 44 |
| 16                                   | High       | 48         | High   | 41 |
| 22                                   | High       | 40         | Medium | 32 |
| 32                                   | High       | 34         | Medium | 28 |

180°. Built-in telescoping lenshood, aperture indexing prong for non-AI Nikon bodies. Deluxe finish and appearance.

**Field test slides:** Our slides—confirming lab bench-test results—were crisp and snappy, with detail very well rendered. There was some softness in the corners wide open but from f/4 through f/32 corner-to-center sharpness proved consistent. Flare was well controlled throughout. Overall, an above-average lens for this focal length, with on-film results matching our positive impressions of its construction and finish.

**Optical bench analysis** (for optical experts only): On axis there was very slight undercorrected spherical aberration, and very slight red flare gone by f/5.6; diffraction limited by f/11. Off axis, some very slight coma mixed with very slight skew-ray flare; very slight lateral color. (September 1985)

## 35-70mm f/3.3-4.5, 70-210mm f/4 AF NIKKORS

**Specifications:** 35-70mm f/3.3-4.5 AF Nikkor, No.2001485 in Nikon autofocus AI-S mount, accepts 52mm accessories; f/3.3 (4.5) to f/22 with full stop detents beginning at f/4 (at 35mm) graduating to f/4.5 to f/32 (at 70mm); minimum aperture lock; min. foc. dist.: 12 in. (0.35m), macro magnification 1:4.4 at 70mm; 2 1/4 in. long, 2 5/8 in. diam. (60 x 66mm); 9 1/16 oz. (275g). \$210.50.

**Specifications:** 70-210mm f/4 AF Nikkor, No. 201145, in Nikon autofocus AI-S bayonet mount; accepts 62mm accessories; f/4 to f/32 with full stop detents; minimum aper-



## Interchangeable Lenses

ture lock; min. foc. dist.: 3 ft. 5 in. (1.1m); macro magnification 1:3.9 at 210mm; 5<sup>5</sup>/<sub>8</sub> in. long, 3 in. diam. (148 x 76.5 mm); 1 lb. 10<sup>3</sup>/<sub>4</sub> oz. (760g). \$411.25.

**Practical comments:** Both lenses feature auto and smooth manual focusing via ribbed front ring, fine satin-black finish, very legible markings with inset distance scale window, 70-210mm slightly bulky and heavy, macro focusing of zooms continuous with maximum magnification at longest focal length judged very useful and convenient.

**Field test slides:** The 35-70mm Nikkor AF slides were also crisp and snappy with detail well rendered. Images shot at full aperture were slightly soft at all focal lengths. Two stops down, corners equalled center sharpness. We saw barrel distortion in slides made at the 35mm focal length. At 70mm, slight pincushion distortion was noted. Flare was well controlled at all apertures. Macro photographs were more than acceptable. We judged the lens to have above average performance for a zoom of this type.

The 70-210mm Nikkor AF provided slides that were crisp and snappy overall. At 70mm and 135mm, corners equalled the center in sharpness by f/5.6. We could see slight barrel distortion at 70mm. At 210mm, sharpness improved at f/5.6 but very slight pincushion distortion was present in the slides. Flare was well controlled at all focal lengths. Macro photographs were average to above average for this type of close focusing zoom. Overall, an average to above average zoom lens.

**Optical bench analysis** (for optical experts): On axis, at 35mm, the 35-70mm Nikkor AF exhibited slight overcorrected spherical aberration and was diffraction limited by f/11. Off axis, slight skew-ray flare was mixed with slight astigmatism which was almost all gone by f/11. Lateral color was present.

At 50mm slight overcorrected spherical aberration was again seen on axis with very slight flare, gone by f/5.6. The lens was diffraction limited by f/11. Off axis, very slight coma could be seen mixed with very slight astigmatism which was almost all gone by f/11. Minimal lateral color was present.

At 70mm, on axis, very slight under-corrected spherical aberration could be seen with very slight flare gone by f/8. The lens was diffraction limited by f/16. Off axis, slight skew-ray flare was present mixed with slight coma almost gone by f/11. Minimal lateral color was present.

The 70-210mm Nikkor AF showed very slight spherical aberration on axis at 70mm. Very slight red flare was gone by f/8. The lens was diffraction limited by f/16. Off axis, we could see very slight skew-ray flare

mixed with very slight coma which was almost all gone by f/11. Lateral color was present.

At 100mm, on axis, very slight overcor-

### RESOLUTION

| NIKKOR AF 35-70mm f/3.3-4.5<br>at 35mm/1:50 |                      |    |                      |    |
|---------------------------------------------|----------------------|----|----------------------|----|
| f/                                          | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 3.3                                         | Excellent            | 50 | Excellent            | 45 |
| 5.6                                         | Excellent            | 56 | Excellent            | 50 |
| 8                                           | Excellent            | 63 | Excellent            | 56 |
| 11                                          | Excellent            | 63 | Excellent            | 56 |
| 16                                          | Excellent            | 56 | Excellent            | 50 |
| 22                                          | Excellent            | 50 | Excellent            | 45 |

### CONTRAST

| NIKKOR AF 35-70mm f/3.3-4.5<br>at 35mm<br>at 30 lines/mm |            |    |            |    |
|----------------------------------------------------------|------------|----|------------|----|
| f/                                                       | Center (%) |    | Corner (%) |    |
| 3.3                                                      | High       | 51 | High       | 39 |
| 5.6                                                      | High       | 60 | High       | 51 |
| 8                                                        | High       | 61 | High       | 50 |
| 11                                                       | High       | 58 | High       | 48 |
| 16                                                       | High       | 53 | High       | 41 |
| 22                                                       | High       | 44 | Medium     | 38 |

### RESOLUTION

| NIKKOR AF 35-70mm f/3.3-4.5<br>at 50mm/1:50 |                      |    |                      |    |
|---------------------------------------------|----------------------|----|----------------------|----|
| f/                                          | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                                           | Excellent            | 50 | Excellent            | 45 |
| 5.6                                         | Excellent            | 56 | Excellent            | 50 |
| 8                                           | Excellent            | 63 | Excellent            | 50 |
| 11                                          | Excellent            | 63 | Excellent            | 56 |
| 16                                          | Excellent            | 56 | Excellent            | 50 |
| 22                                          | Excellent            | 50 | Excellent            | 50 |

### CONTRAST

| NIKKOR AF 35-70mm f/3.3-4.5<br>at 70mm<br>at 30 lines/mm |            |    |            |    |
|----------------------------------------------------------|------------|----|------------|----|
| f/                                                       | Center (%) |    | Corner (%) |    |
| 4.5                                                      | High       | 56 | High       | 38 |
| 5.6                                                      | High       | 61 | High       | 52 |
| 8                                                        | High       | 62 | High       | 53 |
| 11                                                       | High       | 57 | High       | 50 |
| 16                                                       | High       | 55 | High       | 44 |
| 22                                                       | High       | 44 | High       | 39 |

### RESOLUTION

| NIKKOR AF 35-70mm f/3.3-4.5<br>at 70mm/1:4 |                      |    |                      |    |
|--------------------------------------------|----------------------|----|----------------------|----|
| f/                                         | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                        | Excellent            | 51 | Excellent            | 45 |
| 5.6                                        | Excellent            | 57 | Excellent            | 51 |
| 8                                          | Excellent            | 64 | Excellent            | 57 |
| 11                                         | Excellent            | 64 | Excellent            | 57 |
| 16                                         | Excellent            | 57 | Excellent            | 51 |
| 22                                         | V. Good              | 51 | Excellent            | 45 |

### CONTRAST

| NIKKOR AF 35-70mm f/3.3-4.5<br>at 50mm<br>at 30 lines/mm |            |    |            |    |
|----------------------------------------------------------|------------|----|------------|----|
| f/                                                       | Center (%) |    | Corner (%) |    |
| 4                                                        | High       | 55 | High       | 39 |
| 5.6                                                      | High       | 61 | High       | 51 |
| 8                                                        | High       | 62 | High       | 52 |
| 11                                                       | High       | 58 | High       | 49 |
| 16                                                       | High       | 53 | High       | 42 |
| 22                                                       | Medium     | 45 | Medium     | 39 |

## MACRO RESOLUTION

| NIKKOR AF 70-210mm f/4<br>at 210mm/1:4 |                      |    |                      |    |
|----------------------------------------|----------------------|----|----------------------|----|
| f/                                     | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                                      | V. Good              | 36 | Excellent            | 32 |
| 5.6                                    | Excellent            | 40 | Excellent            | 36 |
| 8                                      | V. Good              | 45 | Excellent            | 40 |
| 11                                     | Excellent            | 45 | Excellent            | 40 |
| 16                                     | V. Good              | 40 | V. Good              | 36 |
| 22                                     | V. Good              | 40 | V. Good              | 36 |
| 32                                     | V. Good              | 36 | V. Good              | 32 |

rected spherical aberration was again present with very slight flare gone by f/8. The diffraction limit was reached by f/11. Off axis, very slight skew-ray flare was mixed with very slight astigmatism, almost gone by f/11. There was minimal lateral color.

At 210mm, on axis, very slight overcorrected spherical aberration was present with very slight axial color, gone by f/5.6. The diffraction limit was reached by f/11. Off axis, very slight coma was mixed with slight astigmatism, almost gone by f/11. Minimal lateral color was present. (August 1986)

### PERFORMANCE

| Our Standard                                                                                                    |  | as Tested                          |  |
|-----------------------------------------------------------------------------------------------------------------|--|------------------------------------|--|
| <b>Focal length: ±5%</b><br>( 66.50- 73.50mm)<br>(199.50-220.50mm)                                              |  | 71.68mm<br>208.93mm                |  |
| <b>Aperture: ±5%</b><br>(f/3.80-4.20)<br>at 210mm: (f/3.80-4.20)                                                |  | f/3.91<br>f/4.04                   |  |
| <b>Distortion:</b><br>70mm: (±2%)<br>210mm: (±3.5%)                                                             |  | 0.95% (barrel)<br>0.99% (pincushn) |  |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.0 stops) |  | 0.9 stops<br>0.8 stops             |  |

### RESOLUTION

| NIKKOR AF 70-210mm f/4<br>at 70mm/1:51 |                      |    |                      |    |
|----------------------------------------|----------------------|----|----------------------|----|
| f/                                     | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                                      | Excellent            | 51 | Excellent            | 45 |
| 5.6                                    | Excellent            | 57 | Excellent            | 51 |
| 8                                      | Excellent            | 64 | Excellent            | 57 |
| 11                                     | Excellent            | 64 | Excellent            | 57 |
| 16                                     | Excellent            | 57 | Excellent            | 51 |
| 22                                     | Excellent            | 57 | Excellent            | 51 |
| 32                                     | Excellent            | 51 | Excellent            | 45 |

### CONTRAST

| NIKKOR AF 70-210mm f/4<br>at 70mm<br>at 30 lines/mm |            |    |            |    |
|-----------------------------------------------------|------------|----|------------|----|
| f/                                                  | Center (%) |    | Corner (%) |    |
| 4                                                   | High       | 59 | High       | 44 |
| 5.6                                                 | High       | 62 | High       | 49 |
| 8                                                   | High       | 66 | High       | 52 |
| 11                                                  | High       | 67 | High       | 53 |
| 16                                                  | High       | 57 | High       | 46 |
| 22                                                  | High       | 47 | High       | 37 |
| 32                                                  | High       | 34 | Medium     | 29 |

### RESOLUTION

| NIKKOR AF 70-210mm f/4<br>at 100mm/1:50 |                      |    |                      |    |
|-----------------------------------------|----------------------|----|----------------------|----|
| f/                                      | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                                       | Excellent            | 50 | Excellent            | 45 |
| 5.6                                     | Excellent            | 56 | Excellent            | 50 |
| 8                                       | Excellent            | 63 | Excellent            | 56 |
| 11                                      | Excellent            | 63 | Excellent            | 56 |
| 16                                      | Excellent            | 56 | Excellent            | 50 |
| 22                                      | V. Good              | 50 | Excellent            | 45 |
| 32                                      | Excellent            | 50 | Excellent            | 45 |

### PERFORMANCE

| Our Standard                                                                                                   |  | as Tested                          |  |
|----------------------------------------------------------------------------------------------------------------|--|------------------------------------|--|
| <b>Focal length: ±5%</b><br>( 33.25- 36.75mm)<br>( 66.50- 73.50mm)                                             |  | 35.53mm<br>68.63mm                 |  |
| <b>Aperture: ±5%</b><br>(f/3.14-3.47)<br>at 70mm: (f/4.28-4.73)                                                |  | f/3.31<br>f/4.72                   |  |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>70mm: (±2%)                                                             |  | 0.46% (barrel)<br>0.97% (pincushn) |  |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>70mm: (0-1.3 stops) |  | 0.9 stops<br>0.5 stops             |  |



## CONTRAST

| NIKKOR AF 70-210mm f/4<br>at 100mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 4                                                    | High       | 47 | High       | 37 |
| 5.6                                                  | High       | 57 | High       | 46 |
| 8                                                    | High       | 60 | High       | 47 |
| 11                                                   | High       | 61 | High       | 49 |
| 16                                                   | High       | 53 | High       | 46 |
| 22                                                   | High       | 44 | Medium     | 34 |
| 32                                                   | Medium     | 33 | Medium     | 28 |

## RESOLUTION

| NIKKOR AF 70-210mm f/4<br>at 210mm/1:50 |                   |    |                   |    |
|-----------------------------------------|-------------------|----|-------------------|----|
| f/                                      | Center (Lines/mm) |    | Corner (Lines/mm) |    |
| 4                                       | Excellent         | 50 | Excellent         | 45 |
| 5.6                                     | Excellent         | 56 | Excellent         | 50 |
| 8                                       | Excellent         | 56 | Excellent         | 50 |
| 11                                      | Excellent         | 63 | Excellent         | 56 |
| 16                                      | Excellent         | 56 | Excellent         | 50 |
| 22                                      | Excellent         | 56 | Excellent         | 56 |
| 32                                      | Excellent         | 50 | Excellent         | 45 |

## CONTRAST

| NIKKOR AF 35-70mm f/3.3-4.5<br>at 210mm<br>at 30 lines/mm |            |    |            |    |
|-----------------------------------------------------------|------------|----|------------|----|
| f/                                                        | Center (%) |    | Corner (%) |    |
| 4                                                         | High       | 48 | High       | 36 |
| 5.6                                                       | High       | 58 | High       | 45 |
| 8                                                         | High       | 60 | High       | 46 |
| 11                                                        | High       | 61 | High       | 50 |
| 16                                                        | High       | 50 | High       | 41 |
| 22                                                        | High       | 45 | Medium     | 32 |
| 32                                                        | High       | 34 | Medium     | 29 |

## MACRO RESOLUTION

| NIKKOR AF 35-70mm f/3.3-4.5<br>at 70mm/1:4 |                   |    |                   |    |
|--------------------------------------------|-------------------|----|-------------------|----|
| f/                                         | Center (Lines/mm) |    | Corner (Lines/mm) |    |
| 4.5                                        | V. Good           | 45 | Excellent         | 36 |
| 5.6                                        | V. Good           | 51 | Excellent         | 40 |
| 8                                          | Good              | 51 | Excellent         | 45 |
| 11                                         | Good              | 45 | Excellent         | 40 |
| 16                                         | Good              | 45 | Excellent         | 40 |
| 22                                         | Accept            | 40 | V. Good           | 36 |

TWO WIDE-TO-TELE  
ZOOM NIKKORS

**Specifications:** 35-70mm f/3.5 Zoom-Nikkor, No. 966894 in Nikon AI-S mount, accepts 62mm accessories; f/3.5 to f/22 with full stop detents; min. foc. dist. 2½ ft. (13¼ in. in macro) (0.7m and 0.35m), max. mag 1:4 in macro mode; 3¼ in. long, 2⅞ in. diam. (97mm × 66mm), 18¼ oz. (520g). \$725.00.

**Specifications:** 35-105mm f/3.5-4.5 Zoom-Nikkor, No. 1939949 in Nikon AI-S mount, accepts 52mm accessories; f/3.5 to f/22 with full stop detents; min. foc. dist. 5 ft. (10% in. in macro) (1.4m and 0.27m), max. mag 1:4 in macro mode; 3⅞ in. long, 2½ in. diam. (86.5mm × 64mm), 18 oz. (510g) \$348.00.

**Practical comments:** Very diverse lenses. 35-70mm (10 elements in 9 groups) is two touch (separate zoom and focusing controls) with macro available only in 70mm position by means of special button allowing lens focusing to continue beyond usual range. 35-105mm (16 elements in 12 groups) is actually

smaller than 35-70mm, uses single touch (combined zoom and focusing ring) with macro ring extending entire lens forward, providing max. macro at 35mm but closer focusing than normal at all focal lengths. Has macro magnification scale (which 35-70mm does not) but decreases in aperture ⅔ f/stop from min. focal length to maximum (which 35-70mm does not). Both lenses focus counter-clockwise from infinity to closest focusing distance. Higher price of 35-70mm indicates

## PERFORMANCE

| Our Standard                                                     |  | as Tested                               |  |
|------------------------------------------------------------------|--|-----------------------------------------|--|
| <b>Focal length:</b> ±5%<br>(33.25-36.75mm)<br>(66.50-73.50mm)   |  | 35.84mm<br>69.69mm                      |  |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 70mm: (f/3.33-3.68)  |  | f/3.58<br>f/3.67                        |  |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>70mm: (±2.2%)             |  | under 1% (barrel)<br>under 1% (pincshn) |  |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit |  | 1.3 stops<br>0.2 stops                  |  |
| 35mm: (0-1.9 stops)<br>70mm: (0-1.3 stops)                       |  |                                         |  |

## RESOLUTION

| NIKKOR 35-70mm f/3.5<br>at 35mm<br>at 1: 48 |               |    |               |    |
|---------------------------------------------|---------------|----|---------------|----|
| f/                                          | Center (l/mm) |    | Corner (l/mm) |    |
| 3.5                                         | V. Good       | 48 | Excellent     | 43 |
| 5.6                                         | Excellent     | 54 | Excellent     | 48 |
| 8                                           | Excellent     | 60 | Excellent     | 54 |
| 11                                          | Excellent     | 60 | Excellent     | 54 |
| 16                                          | Excellent     | 54 | Excellent     | 48 |
| 22                                          | V. Good       | 48 | Excellent     | 43 |

## CONTRAST

| NIKKOR 35-70mm f/3.5<br>at 35mm<br>at 30 lines/mm |            |    |            |    |
|---------------------------------------------------|------------|----|------------|----|
| f/                                                | Center (%) |    | Corner (%) |    |
| 3.5                                               | High       | 58 | High       | 51 |
| 5.6                                               | High       | 66 | High       | 55 |
| 8                                                 | High       | 71 | High       | 56 |
| 11                                                | High       | 76 | High       | 48 |
| 16                                                | High       | 66 | High       | 40 |
| 22                                                | High       | 46 | Medium     | 36 |

## RESOLUTION

| NIKKOR 35-70mm f/3.5<br>at 50mm<br>at 1: 49 |               |    |               |    |
|---------------------------------------------|---------------|----|---------------|----|
| f/                                          | Center (l/mm) |    | Corner (l/mm) |    |
| 3.5                                         | V. Good       | 49 | Excellent     | 44 |
| 5.6                                         | Good          | 49 | Excellent     | 44 |
| 8                                           | Good          | 55 | V. Good       | 49 |
| 11                                          | Excellent     | 62 | Excellent     | 55 |
| 16                                          | V. Good       | 55 | Excellent     | 49 |
| 22                                          | Good          | 49 | V. Good       | 44 |

## CONTRAST

| NIKKOR 35-70mm f/3.5<br>at 50mm<br>at 30 lines/mm |            |    |            |    |
|---------------------------------------------------|------------|----|------------|----|
| f/                                                | Center (%) |    | Corner (%) |    |
| 3.5                                               | High       | 59 | High       | 49 |
| 5.6                                               | High       | 64 | High       | 54 |
| 8                                                 | High       | 72 | High       | 58 |
| 11                                                | High       | 74 | High       | 49 |
| 16                                                | High       | 60 | High       | 44 |
| 22                                                | High       | 49 | Medium     | 34 |

## RESOLUTION

| NIKKOR 35-70mm f/3.5<br>at 70mm<br>at 1: 49 |               |    |               |    |
|---------------------------------------------|---------------|----|---------------|----|
| f/                                          | Center (l/mm) |    | Corner (l/mm) |    |
| 3.5                                         | V. Good       | 49 | Excellent     | 44 |
| 5.6                                         | Good          | 49 | Excellent     | 44 |
| 8                                           | Good          | 55 | Excellent     | 49 |
| 11                                          | Excellent     | 62 | Excellent     | 55 |
| 16                                          | V. Good       | 55 | Excellent     | 49 |
| 22                                          | Good          | 49 | Excellent     | 44 |

## CONTRAST

| NIKKOR 35-70mm f/3.5<br>at 70mm<br>at 30 lines/mm |            |    |            |    |
|---------------------------------------------------|------------|----|------------|----|
| f/                                                | Center (%) |    | Corner (%) |    |
| 3.5                                               | High       | 58 | High       | 47 |
| 5.6                                               | High       | 61 | High       | 50 |
| 8                                                 | High       | 71 | High       | 53 |
| 11                                                | High       | 65 | High       | 50 |
| 16                                                | High       | 50 | High       | 42 |
| 22                                                | High       | 45 | High       | 36 |

## MACRO RESOLUTION

| NIKKOR 35-70mm f/3.5<br>at 70mm<br>at 1: 4 |               |    |               |    |
|--------------------------------------------|---------------|----|---------------|----|
| f/                                         | Center (l/mm) |    | Corner (l/mm) |    |
| 3.5                                        | Accept        | 36 | V. Good       | 29 |
| 5.6                                        | Accept        | 40 | Good          | 29 |
| 8                                          | Accept        | 45 | Accept        | 29 |
| 11                                         | Good          | 45 | Good          | 32 |
| 16                                         | Good          | 45 | Good          | 32 |
| 22                                         | Good          | 45 | Good          | 32 |

## PERFORMANCE

| Our Standard                                                     |  | as Tested                   |  |
|------------------------------------------------------------------|--|-----------------------------|--|
| <b>Focal length:</b> ±5%<br>(33.25- 36.75mm)<br>(99.75-110.25mm) |  | 36.30mm<br>103.25mm         |  |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 105mm: (f/4.28-4.73) |  | f/3.48<br>f/4.71            |  |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>105mm: (±2.5%)            |  | under 1%<br>1.38% (pincshn) |  |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit |  | 1.4 stops<br>0.5 stops      |  |
| 35mm: (0-1.9 stops)<br>105mm: (0-1.1 stops)                      |  |                             |  |

## RESOLUTION

| NIKKOR 35-105mm f/3.5-4.5<br>at 35mm<br>at 1: 49 |               |    |               |    |
|--------------------------------------------------|---------------|----|---------------|----|
| f/                                               | Center (l/mm) |    | Corner (l/mm) |    |
| 3.5                                              | V. Good       | 49 | Excellent     | 44 |
| 5.6                                              | V. Good       | 49 | Excellent     | 49 |
| 8                                                | V. Good       | 55 | Excellent     | 49 |
| 11                                               | Excellent     | 62 | Excellent     | 55 |
| 16                                               | Excellent     | 55 | Excellent     | 49 |
| 22                                               | Excellent     | 55 | Excellent     | 49 |

## CONTRAST

| NIKKOR 35-105mm f/3.5-4.5<br>at 35mm<br>at 30 lines/mm |            |    |            |    |
|--------------------------------------------------------|------------|----|------------|----|
| f/                                                     | Center (%) |    | Corner (%) |    |
| 3.5                                                    | High       | 57 | High       | 51 |
| 5.6                                                    | High       | 65 | High       | 53 |
| 8                                                      | High       | 71 | High       | 55 |
| 11                                                     | High       | 74 | High       | 46 |
| 16                                                     | High       | 62 | High       | 40 |
| 22                                                     | High       | 47 | Medium     | 38 |



## Interchangeable Lenses

### RESOLUTION

| NIKKOR 35-105mm f/3.5-4.5<br>at 50mm<br>at 1: 49 |                  |    |                  |    |
|--------------------------------------------------|------------------|----|------------------|----|
| f/                                               | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                              | Excellent        | 55 | Excellent        | 49 |
| 5.6                                              | Excellent        | 62 | Excellent        | 49 |
| 8                                                | V. Good          | 62 | Excellent        | 55 |
| 11                                               | Excellent        | 62 | Excellent        | 55 |
| 16                                               | V. Good          | 55 | Excellent        | 49 |
| 22                                               | V. Good          | 55 | Excellent        | 49 |

### CONTRAST

| NIKKOR 35-105mm f/3.5-4.5<br>at 50mm<br>at 30 lines/mm |                 |    |                 |    |
|--------------------------------------------------------|-----------------|----|-----------------|----|
| f/                                                     | Center<br>( % ) |    | Corner<br>( % ) |    |
| 3.5                                                    | High            | 50 | High            | 47 |
| 5.6                                                    | High            | 59 | High            | 50 |
| 8                                                      | High            | 63 | High            | 51 |
| 11                                                     | High            | 71 | High            | 54 |
| 16                                                     | High            | 61 | High            | 43 |
| 22                                                     | Medium          | 43 | Medium          | 36 |

### RESOLUTION

| NIKKOR 35-105mm f/3.5-4.5<br>at 105mm<br>at 1: 49 |                  |    |                  |    |
|---------------------------------------------------|------------------|----|------------------|----|
| f/                                                | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 4.5                                               | Excellent        | 55 | Excellent        | 49 |
| 5.6                                               | Excellent        | 62 | Excellent        | 49 |
| 8                                                 | V. Good          | 62 | Excellent        | 55 |
| 11                                                | Excellent        | 62 | Excellent        | 55 |
| 16                                                | V. Good          | 55 | Excellent        | 49 |
| 22                                                | V. Good          | 55 | Excellent        | 49 |

### CONTRAST

| NIKKOR 35-105mm f/3.5-4.5<br>at 105mm<br>at 30 lines/mm |                 |    |                 |    |
|---------------------------------------------------------|-----------------|----|-----------------|----|
| f/                                                      | Center<br>( % ) |    | Corner<br>( % ) |    |
| 4.5                                                     | High            | 55 | High            | 45 |
| 5.6                                                     | High            | 59 | High            | 51 |
| 8                                                       | High            | 63 | High            | 53 |
| 11                                                      | High            | 72 | High            | 55 |
| 16                                                      | High            | 60 | High            | 47 |
| 22                                                      | High            | 44 | High            | 38 |

### MACRO RESOLUTION

| NIKKOR 35-105mm f/3.5-4.5<br>at 35mm<br>at 1: 4 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/                                              | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                             | Accept           | 32 | V. Good          | 29 |
| 5.6                                             | Accept           | 32 | V. Good          | 29 |
| 8                                               | Accept           | 36 | Good             | 29 |
| 11                                              | Good             | 40 | Good             | 29 |
| 16                                              | V. Good          | 45 | Accept           | 25 |
| 22                                              | V. Good          | 45 | Accept           | 25 |

more complicated optical design caused by more sophisticated macro mode, constant aperture through zoom range. Both lenses made and finished to usual high Nikkor standard.

**Field test slides:** The 35-105mm f/3.5-4.5 Nikkor slides showed some softness wide open at 35mm with sharpness increasing to f/8 after which it was maintained. Pictures made at 50 and 105mm showed similar results. However, a complex mustache-shaped linear distortion was seen at 35mm. Overall, slides were crisp and snappy with an average to above average performance for a

lens of this type. However, macro performance was above average.

The 35-70mm f/3.5 Nikkor also had very slight softness wide open but sharpness increased measurably by f/5.6. This was also true at 50 and 70mm. Corners at all focal lengths held up well with flare always well controlled. Macro quality was above average for a lens of this type (see charts). Overall performance in picture taking was judged to be superior.

**Optical bench analysis** (for optical experts only): On axis, the 35-105mm f/5-4.5 Nikkor on axis at 35mm showed slight over-corrected spherical aberration and slight axial color. It was diffraction limited by f/8. Off axis, slight skew-ray flare was mixed with very slight astigmatism. There was lateral color throughout. At 50mm on axis, performance was similar to that at 35mm. Off axis, performance was also similar to 35mm but with slight coma instead of astigmatism. At 105mm, spherical aberration was slightly undercorrected on axis, mixed with very slight yellow flare. It was diffraction limited by f/8. Off axis, slight skew-ray flare persisted with slight astigmatism but again with lateral color throughout.

The 35-70mm f/3.5 Nikkor exhibited slight axial color on axis at 35mm with very slight overcorrected spherical aberration. It was diffraction limited by f/8. Off axis we could see slight skew-ray flare mixed with astigmatism. Lateral color was present throughout. On and off axis at 50mm performance was similar to that at 35mm. The same was true on axis at 70mm but off axis the previously noted astigmatism gave way to coma. (January 1985)

## NEW NOVOFLEX 400 HAS LATEST GLASS

**Specifications:** 400mm f/5.6 Quick focusing Novoflexar, No. 49125 in interchangeable mounts for Leica, Nikon, Canon, Minolta (MD and Maxxum), Olympus, Pentax KA, Yashica-Contax, Universal Thread, Hasselblad 2000 FC, Mamiya 645, Rollei SL66, Pentax 645, others on request. Accepts 77mm accessories, f/5.6-f/32, detents at full stops, min. foc. dis. 6 ft. 3 in. (1.9 meters); Length, 1 ft. 4 1/16 in. with Rapid-Focus Grip Assembly and lens hood, diam. 3 1/2 in. (89mm); weight, 4 lb. 14 oz. (2205g); Price, \$1329.95 including mount, lens hood, and shoulder chest pod.

**Practical Comments:** Lens consists of telescoping barrel, containing optics, and spring-loaded, right-handed, trigger grip which is squeezed and released to focus. At the front of the grip a conveniently located, left-hand-operated handle, with button connected to camera by cable release lets you support front of lens and fire the camera. A large ring allows you to lock focus.

The lens is held much as a rifle, and one-handed "Follow-Focus" allows rapid and convenient tracking of subject while focusing. Dual grip extensions make it particularly easy to hold and aim. Front grip can be pivoted to clear tripod head platform when needed. Grip assembly has a camera body rotating ring to permit vertical positioning. The lock ring can be loosened or tightened to adjust friction, can be set to hold focus when grip is released slightly. Focusing is quick, but at f/5.6 focusing image is only moderately bright and focusing by squeeze-

### PERFORMANCE

| Our Standard                                                                        |  | as Tested      |
|-------------------------------------------------------------------------------------|--|----------------|
| <b>Focal length:</b> ±5%<br>(380.0-420.0mm)                                         |  | 411.1mm        |
| <b>Aperture:</b> ±5%<br>(f/5.32-f/5.88)                                             |  | f/5.80         |
| <b>Distortion:</b><br>(at 400mm-±3.5%)                                              |  | 1.1% (pincshn) |
| <b>Light falloff:</b> at f/8.0<br>(+1 stop from theoretical limit)<br>(0-1.0) stops |  | 0.4 stops      |

### RESOLUTION

| Novoflex 400mm f/5.6<br>at 1:50 |                      |    |                      |    |
|---------------------------------|----------------------|----|----------------------|----|
| f/                              | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 5.6                             | Good                 | 36 | V. Good              | 28 |
| 8                               | V. Good              | 40 | V. Good              | 32 |
| 11                              | Excellent            | 45 | V. Good              | 36 |
| 16                              | Excellent            | 50 | Excellent            | 40 |
| 22                              | Excellent            | 50 | Excellent            | 45 |
| 32                              | V. Good              | 45 | Excellent            | 40 |

### CONTRAST

| Novoflex 400mm f/5.6<br>at 30 lines/mm |            |    |            |    |
|----------------------------------------|------------|----|------------|----|
| f/                                     | Center (%) |    | Corner (%) |    |
| 5.6                                    | Medium     | 35 | High       | 34 |
| 8                                      | Medium     | 35 | High       | 34 |
| 11                                     | High       | 46 | High       | 43 |
| 16                                     | High       | 47 | High       | 44 |
| 22                                     | High       | 41 | Medium     | 32 |
| 32                                     | Medium     | 28 | Low        | 26 |

ing grip handle requires some initial practice.

Apertures are click-stop only, without pre-set or auto diaphragm control. However, the lens is most often used at maximum aperture (to permit the fastest shutter speed for lighting conditions). Use of latest glass permits improved performance at f/5.6 compared to older models.

Once proficiency was attained, the Novoflex proved very easy to handle and action pictures taken with it were sharp and well framed, indicating that its unique rapid focusing system is workable and worthwhile. Special adaptors are being made available to fit medium format cameras (see specifications). Accessories include drop-in filters, an equipment bag (\$75), and assorted cable releases.

**Field Test Slides:** Color transparencies were sharp over entire 35mm format, with little sign of color fringing or green haze in the shadow areas of the image. A very slight softness was found when maximum aperture exposures were compared with those taken at f/11. Overall optical performance is good, aided by ability to focus rapidly when shooting moving subjects.

**Optical bench analysis** (for optical experts): A small amount of overcorrected spherical aberration at maximum aperture, gone at f/11. Slight red-green color flare was noted. Focus shift between red and green light is 0.60mm, typical for lenses of this focal length. Off axis (at 2.5°) very slight lateral color but not enough to affect image quality. A small amount of astigmatism and coma disappeared at around f/12.5. Off axis, image pattern excellent. Off axis, aberrations are small for larger angles indicating image quality remains very good for larger formats, such as 4.5x6 and 6x6cm. (June 1986)



## AN ULTRACOMPACT ULTRAWIDE OLYMPUS

**Specifications:** 18mm f/3.5 Zuiko MC Auto-W; fixed mount for Olympus SLRs; No. 103672; accepts 72mm filters w. access. filter holder; f/3.5 to f/16; full stop detents; min. foc. dist. 9<sup>1</sup>/<sub>16</sub> in. (.25mm); 1<sup>1</sup>/<sub>8</sub> in. long, 2<sup>3</sup>/<sub>8</sub> in. diam. (25×61mm); 8<sup>1</sup>/<sub>2</sub> oz. (247 g); \$750.00 w. case.

**Practical comments:** Olympus' widest wide angle, scaled down in size for compact SLRs. Eleven elements in 9 groups, floating element covers 100° field, focuses to 10 in. diamond textured rubber focusing ring, knurled 3/16-in. front mounted diaphragm ring. All numerals are engraved for easy legibility.

A good performer. Our only caveat would be to stress the fragility of the fish-eye-like protruding front element which sticks out nearly 1/4 in. beyond the protecting metal mount rim. Invest in Olympus' Adapter Ring 49-72mm and keep it permanently mounted on the lens to protect it. If you use a 49mm

### PERFORMANCE

| Our Standard                                                                      |  | as tested          |
|-----------------------------------------------------------------------------------|--|--------------------|
| <b>Focal length:</b> ±5%<br>(17.10–18.90mm)                                       |  | 18.76mm            |
| <b>Aperture:</b> ±5%<br>(f/3.33–3.68)                                             |  | f/3.51             |
| <b>Distortion:</b><br>(±4%)                                                       |  | under 1% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0–4.0 stops) |  | 3.4 stops          |

### RESOLUTION

| ZUIKO 18mm f/3.5<br>at 1:49.01 |                  |    |                  |    |
|--------------------------------|------------------|----|------------------|----|
| f/                             | Center<br>(l/mm) |    | Corner<br>(1/mm) |    |
| 3.5                            | Excellent        | 55 | Excellent        | 44 |
| 5.6                            | Excellent        | 62 | Excellent        | 44 |
| 8                              | V. Good          | 55 | Excellent        | 49 |
| 11                             | V. Good          | 55 | Excellent        | 44 |
| 16                             | V. Good          | 55 | Excellent        | 44 |

### CONTRAST

| ZUIKO 18mm f/3.5<br>at 30 lines/mm |                 |    |                 |    |
|------------------------------------|-----------------|----|-----------------|----|
| f/                                 | Center<br>( % ) |    | Corner<br>( % ) |    |
| 3.5                                | High            | 57 | High            | 40 |
| 5.6                                | High            | 67 | High            | 41 |
| 8                                  | High            | 72 | High            | 48 |
| 11                                 | High            | 74 | High            | 49 |
| 16                                 | High            | 66 | High            | 50 |

filter directly, you will scratch the lens and the filter.

**Field test slides:** Our slides were sharp and crisp at all apertures, holding well into the corners. Stopping all the way down to f/16 was required before diffraction effects surfaced. Minimal linear distortion for an 18mm lens.

**Optical bench report:** (for optical experts only) On axis, we saw slight yellow flare wide-open, but performance was near diffraction limits by f/5.6. Off axis, the image was weaker, with slight lateral color and skew ray flare. Flare gone by f/8.6. (September 1984)

## SUPERWIDE PC LENS FROM OLYMPUS

**Specifications:** 24mm f/3.5 Olympus Zuiko Shift in fixed bayonet mounts for Olympus OM series SLRs; f/3.5 to f/22, click stops at full stop intervals; min. foc. dist. 1.25 ft. (.35m). Shifts ±8mm and rises ±10mm; built-in 4 filter turret; no provision for front-mounted accessories, integral cut-away lens shade; semi-automatic control of diaphragm.

Serial No.: 101456. Size: 3<sup>3</sup>/<sub>8</sub> in. diam. × 3 in. long (85mm × 76mm). Weight: 1 lb. 2<sup>3</sup>/<sub>8</sub> oz. (522g) Price: \$1085.00 with fitted case.

**Practical comments:** Perspective control (better known as PC) lenses have been around for a long time, but this one allows the user to move the lens up to 10mm off the optical axis without appreciable loss of sharpness or fall-off in illumination despite its ultra-wide length and relatively wide f/3.5 aperture. To achieve this requires the lens to cover a 57mm circle—an angle of view of about 100°, so the Olympus' 24mm Shift uses 12 elements in 10 groups, one of which is a deeply curved 72mm front element reminiscent of a fish-eye lens. At first glance, its optical construction looks like that of a fish-eye, yet the lens shows a low 1.09% barrel distortion. Light fall-off at the extreme edges of the image in full shift position is a measured 2.3 stops. In actual field tests, however, it is barely noticeable, even at the extreme off-axis position.

Because of its wide angle of view and high speed, front-mounted filters and attachments cannot be fitted. Instead, the 24mm PC has a rotating, click-stopped filter wheel positioning neutral, Y48 yellow, O56 orange and R60 red filters within the lens.

Although the rear cell of the lens is easily accessible, it is unthreaded. With some ingenuity, it could be adopted to take small screw-in auxiliary filters or gelatin cut-outs.

The lens is lightweight and well-balanced in spite of its impressive size and is easy to handle in all respects. Like its older but more conservative brother, the Zuiko 35 Shift, the 24 has a bottom-mounted diaphragm stop-down lever. Push it in and the lens stops down for shooting. Push again, and it opens up for focusing and viewing—a commendable convenience but you must keep your wits about you when changing lenses rapidly lest you forget that you've now mounted a lens without an automatic diaphragm. If your Olympus SLR is in aperture-preferred auto-exposure mode, a glance at the shutter speed indicator should remind you. However, in manual mode, it is recommended that you read your set aperture with the lens centered, and then shift. Also, in automatic mode, the exposure indicated in the finder may not be correct when the lens is shifted but the exposure on film proved to be quite accurate when using Olympus models which read off the film plane (e.g. the OM-2, OM-2 S program, and OM-4).

Controls, from front to rear are as follows: A thin 1/8 in. wide knurled filter setting ring clicks into position (make sure it does as intermediate position, will blend filter effects unpredictably). Next, a 3/32 in. wide aperture ring sets white engraved f/stops opposite a white indicator. A 3/4 in. in wide Olympus diamond patterned rubber focusing grip comes next. Footage scales are in gold, meters in

## Interchangeable Lenses

### PERFORMANCE

| Our Standard                                                                      |  | as Tested      |
|-----------------------------------------------------------------------------------|--|----------------|
| <b>Focal length:</b> ±5%<br>(22.80-25.20mm)                                       |  | 24.06mm        |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)                                             |  | f/3.43         |
| <b>Distortion:</b><br>(±4%)                                                       |  | 1.09% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-3.0 stops) |  | 2.3 stops      |

### RESOLUTION

| OLYMPUS SHIFT 24mm f/3.5<br>at 1:49 |                  |    |                  |    |
|-------------------------------------|------------------|----|------------------|----|
| f/                                  | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.5                                 | Excellent        | 55 | Excellent        | 44 |
| 5.6                                 | Excellent        | 62 | Excellent        | 49 |
| 8                                   | Excellent        | 69 | Excellent        | 49 |
| 11                                  | Excellent        | 69 | Excellent        | 49 |
| 16                                  | Excellent        | 62 | Excellent        | 49 |
| 22                                  | V. Good          | 55 | Excellent        | 44 |

### CONTRAST

| OLYMPUS SHIFT 24mm f/3.5<br>at 30 lines/mm |                 |    |                 |    |
|--------------------------------------------|-----------------|----|-----------------|----|
| f/                                         | Center<br>( % ) |    | Corner<br>( % ) |    |
| 3.5                                        | High            | 48 | High            | 30 |
| 5.6                                        | High            | 58 | High            | 34 |
| 8                                          | High            | 58 | Medium          | 39 |
| 11                                         | High            | 56 | Medium          | 37 |
| 16                                         | High            | 51 | Medium          | 35 |
| 22                                         | Medium          | 37 | Low             | 28 |

white, and white depth of field indicators engraved for every other f/stop. Engraved, white millimeter scales with central indicators and click stops indicate the degree of sideways shift and vertical rise or fall. No creep was found on either setting, a tribute to the effective oil damping of the twin dove-tail soliders. Mechanical stops on both movements keep you from exceeding the lens' coverage in any direction. In practice, you just look through the finder and move the lens whichever way you want with your focusing hand. It's very fast and easy to use. The lens close-focuses to 15 in. without changing length—the focusing mechanism is internal.

All in all, this is a lens to gladden the heart of any architectural photographer working in confined spaces inside or out.

**Field test slides:** Our Kodachrome slides were sharp and contrasty at all settings, and were judged excellent 2 or 3 stops down from maximum aperture. Unshifted, slides were sharp and contrasty without color fringing. The colors showed slight softness wide-open, and slight green-purple fringing. Performance was much improved when stopped down 2 stops. At 10mm (full) shift, sharpness was still good centrally with slight loss of contrast. Corner images showed slight softness due to astigmatism but improved greatly at f/5.6 on down.

**Optical bench analysis** (for optical experts only): On axis, very slight overcorrected spherical aberration at f/3.5, with the lens diffraction limited by f/8. Off axis, slight skew-ray flare with slight coma and slight astigmatism which were gone by f/8. A slight lateral color was present throughout. With the lens shifted 5mm, we found a slight high order coma, with very slight lateral color. Coma was gone by f/5.6. Shifted 10mm, we saw a slight yellow skew-ray flare to f/5.6. Lateral color negligible. (January 1985)



## OLYMPUS 40mm f/2 COMPACT & 500mm f/8

**Specifications:** 40mm f/2 Zuiko Auto-S. Olympus bayonet mount; No. 101963 accepts 49mm accessories; f/2 to f/16, full stop detents; min. foc. dist., 12 in. (0.3m); focusing turns clockwise 190° to inf.; 1 1/8 in. long, 2 1/2 in. diam. (27mm x 58mm); 5 oz. (140g); \$142.00.

500mm f/8 Zuiko Reflex; Olympus bayonet mount; No. 101753; accepts 72mm accessories; built-in sliding lens hood, single f/8 aperture, min. foc. dist. 13 ft. (4m); focusing turns clockwise 190° to inf.; 3 1/8 in. long, 3 3/8 in. diam. (97mm x 81mm); 1 lb. 4 3/4 oz. (590g); \$500.00.

**Practical comments:** Typical well finished, satin black smooth operating optics with grippable rubberized focusing rings. Six element, six group 40mm f/2 is 8mm shorter, 1 oz. lighter than 50mm f/1.8. At close focus image is larger than 50mm f/1.8 with ratio of 1:5 vs. 50mm's 1:7. Five elements in two groups 500mm f/8 Zuiko is more compact, lighter than most camera manufacturer's lenses of similar specifications.

### PERFORMANCE

| Our Standard                                                                      | as Tested     |
|-----------------------------------------------------------------------------------|---------------|
| <b>Focal length:</b> + -5%<br>(38.00-42.00mm)                                     | 41.33mm       |
| <b>Aperture:</b> + -5%<br>(f/1.90-2.10)                                           | f/2.03        |
| <b>Distortion:</b><br>(+ -2.5%)                                                   | 1.5% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.7 stops) | .906 stops    |

### RESOLUTION

| OLYMPUS ZUIKO 40mm f/2<br>at 1:49 |                  |                  |           |    |
|-----------------------------------|------------------|------------------|-----------|----|
| f/                                | Center<br>(1/mm) | Corner<br>(1/mm) |           |    |
| 2                                 | V. Good          | 55               | Excellent | 39 |
| 2.8                               | V. Good          | 62               | V. Good   | 44 |
| 4                                 | V. Good          | 69               | Good      | 44 |
| 5.6                               | V. Good          | 69               | Good      | 49 |
| 8                                 | Good             | 62               | Good      | 49 |
| 11                                | V. Good          | 62               | V. Good   | 49 |
| 16                                | Good             | 55               | Good      | 44 |

### CONTRAST

| OLYMPUS ZUIKO 40mm f/2<br>at 30 lines/mm |               |               |        |    |
|------------------------------------------|---------------|---------------|--------|----|
| f/                                       | Center<br>(%) | Corner<br>(%) |        |    |
| 2                                        | High          | 46            | Medium | 28 |
| 2.8                                      | High          | 54            | Medium | 30 |
| 4                                        | High          | 64            | Medium | 34 |
| 5.6                                      | High          | 63            | Medium | 38 |
| 8                                        | High          | 63            | Medium | 44 |
| 11                                       | High          | 60            | High   | 48 |
| 16                                       | High          | 53            | High   | 43 |

**Field test slides:** 40mm f/2: Well controlled flare, slightly softer images at full aperture. 500mm f/8: Some flare could be seen, typical of mirror lens; picture images were sharp from center to corners.

**Optical bench analysis:** (for optical experts only): 40mm f/2: On axis, astigmatism was gone by f/8, overcorrected spherical aberration, and slight yellow flare were present. Off axis, skew-ray flare was almost gone by f/8.

### PERFORMANCE

| Our Standard                                                                    | as Tested          |
|---------------------------------------------------------------------------------|--------------------|
| <b>Focal length:</b> + -5%<br>(475.00-525.00mm)                                 | 498.39mm           |
| <b>Aperture:</b> + -5%<br>(f/7.60-8.40)                                         | f/8.27             |
| <b>Distortion:</b><br>(+ -3.5%)                                                 | 1.04% (pincushion) |
| <b>Light falloff:</b> at f/8<br>+1 stop from theoretical limit<br>(0-1.0 stops) | 0.8 stops          |

### RESOLUTION

| OLYMPUS ZUIKO 500mm f/8<br>at 1:45 |                  |                  |           |    |
|------------------------------------|------------------|------------------|-----------|----|
| f/                                 | Center<br>(1/mm) | Corner<br>(1/mm) |           |    |
| 8                                  | Good             | 45               | Excellent | 40 |

### CONTRAST

| OLYMPUS ZUIKO 500mm f/8<br>at 30 lines/mm |               |               |      |    |
|-------------------------------------------|---------------|---------------|------|----|
| f/                                        | Center<br>(%) | Corner<br>(%) |      |    |
| 8                                         | High          | 58            | High | 55 |

Slight lateral color was observed throughout. 500mm f/8: On axis, the image appeared slightly soft with slight orange flare. Off axis, image was again slightly soft, with slight lateral color and flare. (August 1984)

## OLYMPUS AF DUO: WIDE AND TELE ZOOM

**Specifications:** 28mm f/2.8 Olympus AF in mount for Olympus autofocus SLRs, No. 102073, accepts 49mm accessories; f/2.8-16, electronically set by camera; min. foc. dist.: 1 ft. (0.3m), 1-3/8 in. long, 2-1/2 in. diam. (36mm x 62mm); 6-1/16 oz. (172g). Built-in extendable lens shade. \$183 with case.

**Specifications:** 70-210mm f/3.5-4.5 Olympus AF Zoom in mount for Olympus autofocus SLRs, No. 1001563, accepts 55mm accessories; f/3.5-4.5 to 22, set electronically by camera; min. foc. dist.: 5 ft. (1.5m) in "close-focus" mode, 5-1/16 in. long, 3-1/8 in. diam. (130mm x 78mm); 1 lb., 11-1/2 oz. (780g). \$340 with case.

**Practical comments:** Both lenses lack external focusing and diaphragm controls since they are designed for autofocus or manual power-focus from body controls only. Distance set appears in easily readable orange (feet) or white (meters) in transparent window atop lens barrels. Depth-of-field scale for f/11, f/22 on 28mm, five-focal-length IR index on 70-210mm. Non-skid panels provide hand grip on both lenses. Well-finished matte black lens bodies offer generous gripping surfaces due to lack of external moving parts. These lenses are designed for Olympus autofocus SLRs only.

Compact, lightweight, fast 28mm wide-angle has built-in 4mm deep extendable lens shade, takes standard 49mm lens accessories.

Fast 70-210mm autofocusing zoom has single 1-3/8 in.-wide rubberized zoom ring, sets zoom focal length between 70 and 210mm (legibly marked in green, at 70, 80,

100, 135, and 210mm). Transparent window in lens barrel shows distance set, footage in orange, meters in white, red dots show infrared focus mark at different focal lengths. No depth-of-field scale. Takes 55mm filters and accessories.

**Field test slides:** Slides shot with the 28mm were crisp and snappy. At maximum aperture, corners were slightly soft, reaching central sharpness by f/5.6. Very slight barrel distortion. Flare well controlled throughout. Overall, an above average lens.

The 70-210mm produced sharp and contrasty slides. At 70mm, slight color fringing wide open disappeared by f/4.5. Very slight softness wide open, corners equaled central sharpness by f/5.6. Very slight barrel distortion noted. At 135 and 210mm, corners were slightly soft wide open, but equaled central sharpness by f/8. Very slight pincushion distortion at 210mm. Flare well controlled throughout.

**Optical bench report** (for optical experts only): The 28mm, on axis, showed overcorrected spherical aberration, very slight red flare gone by f/5.6. Diffraction limit was reached by f/16. Off axis, very slight skew-ray flare mixed with very slight astigmatism, lateral color present.

The zoom, at 70mm on axis, showed very slight overcorrected spherical and very slight yellow flare gone by f/8. Diffraction limit was reached by f/16. Off axis, very slight skew-ray flare mixed with very slight astigmatism, almost gone by f/16. Some lateral color present. At 135, on axis, overcorrected spherical aberration, very slight red-yellow flare gone by f/8. Diffraction limit was reached by f/16. Off axis, very slight astigmatism, almost gone by f/16. Lateral color present. At 210, on axis, very slight overcorrected spherical aberration, very slight red flare, gone two stops down, diffraction limit was reached by f/16. Off axis, slight skew-ray flare mixed with very slight astigmatism almost gone by f/16. Lateral color present.

### PERFORMANCE

| Our Standard                                                                      | as Tested      |
|-----------------------------------------------------------------------------------|----------------|
| <b>Focal length:</b> ±5%<br>(26.60-29.40mm)                                       | 28.06mm        |
| <b>Aperture:</b> ±5%<br>(f/2.66-2.94)                                             | f/2.89         |
| <b>Distortion:</b><br>(±2.5%)                                                     | 0.50% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-2.0 stops) | 0.5 stops      |

### RESOLUTION

| OLYMPUS AF 28mm f/2.8<br>at 1:51 |               |               |           |    |
|----------------------------------|---------------|---------------|-----------|----|
| f/                               | Center (l/mm) | Corner (l/mm) |           |    |
| 2.8                              | Good          | 45            | Excellent | 40 |
| 4                                | V. Good       | 51            | Excellent | 45 |
| 5.6                              | V. Good       | 57            | Excellent | 51 |
| 8                                | Excellent     | 64            | Excellent | 51 |
| 11                               | Excellent     | 57            | Excellent | 51 |
| 16                               | Excellent     | 51            | Excellent | 45 |
| 22                               | V. Good       | 51            | Excellent | 45 |

### CONTRAST

| OLYMPUS AF 28mm f/2.8<br>at 30 lines/mm |            |            |      |    |
|-----------------------------------------|------------|------------|------|----|
| f/                                      | Center (%) | Corner (%) |      |    |
| 2.8                                     | High       | 56         | High | 40 |
| 4                                       | High       | 59         | High | 46 |
| 5.6                                     | High       | 72         | High | 55 |
| 8                                       | High       | 65         | High | 52 |
| 11                                      | High       | 60         | High | 49 |
| 16                                      | Low        | 42         | Low  | 30 |
| 22                                      | V. Low     | 30         | Low  | 25 |



## PERFORMANCE

| Our Standard                                                                                                    | as Tested                         |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Focal length: ±5%</b><br>(66.50-73.50mm)<br>(199.50-220.50mm)                                                | 72.90mm<br>200-70mm               |
| <b>Aperture: ±5%</b><br>(f/3.33-3.68)<br>at 210mm: (f/4.28-4.73)                                                | 1/3.67<br>1/4.64                  |
| <b>Distortion:</b><br>70mm: (±2%)<br>210mm: (±3.5%)                                                             | 0.46% (barrel)<br>0.98% (pincshn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.0 stops) | 0.3 stops<br>0.6 stops            |

## RESOLUTION

### OLYMPUS 70-210mm f/3.5-4.5 at 70mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 3.5 | Excellent     | 56 Excellent 45 |
| 5.6 | Excellent     | 56 Excellent 50 |
| 8   | Excellent     | 63 Excellent 56 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | V. Good       | 50 Excellent 45 |
| 22  | Good          | 45 Excellent 40 |

### at 135mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 3.5 | Excellent     | 50 Excellent 45 |
| 5.6 | Excellent     | 56 Excellent 50 |
| 8   | Excellent     | 63 Excellent 56 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | V. Good       | 50 Excellent 45 |
| 22  | Good          | 45 Excellent 40 |

### at 210mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4.5 | Excellent     | 50 Excellent 45 |
| 5.6 | Excellent     | 56 Excellent 50 |
| 8   | Excellent     | 63 Excellent 56 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | Excellent     | 50 Excellent 45 |
| 22  | Excellent     | 45 Excellent 40 |

## CONTRAST

### OLYMPUS 70-210mm f/3.5-4.5 at 70mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 3.5 | High       | 49 High 35 |
| 5.6 | High       | 50 High 36 |
| 8   | High       | 61 High 50 |
| 11  | High       | 56 High 44 |
| 16  | High       | 51 High 40 |
| 22  | Medium     | 34 Low 24  |

### at 135mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 3.5 | High       | 48 High 36 |
| 5.6 | High       | 50 High 39 |
| 8   | High       | 59 High 46 |
| 11  | High       | 55 High 43 |
| 16  | High       | 52 High 41 |
| 22  | Medium     | 34 Low 26  |

### at 210mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4.5 | High       | 50 High 37 |
| 5.6 | High       | 52 High 39 |
| 8   | High       | 60 High 48 |
| 11  | High       | 54 High 40 |
| 16  | High       | 51 High 42 |
| 22  | Medium     | 35 Low 24  |

## 35-70mm f/3.5-4.5 AF ZOOM FOR OM77AF

**Specifications:** 35-70mm f/3.5-4.5 AF Zoom, No. 1005226 in Olympus AF OM bayonet mount, accepts 49mm accessories; f/3.5 (f/4.5 at 70mm)-f/22 (f/32 at 70mm), continuous automatic f/stop settings, no manual f/stop settings except f/4 for flash; infrared focusing indicator dots, min. foc. dist.: 30 in. (0.75m); close focus 18 in. (0.45m); 2-1/4 in. long, 2-3/4 in. diam.; (53x69mm); 8-7/8 oz. (250g). Price: \$200.

**Practical comments:** No manual focusing ring—auto or power focus only; no aperture scale on lens, apertures appear in finder only; no depth-of-field scale but infrared indicator dots for 35mm, 50mm and 70mm focal lengths; lens finished in shiny black with rubberized finger grips on opposing sides of the lens barrel. Lens close focuses continuously from infinity at all focal lengths. Special note: Maximum aperture at 35mm measures greater than our tolerance specifications (see Performance Data) but this actually provides you with slightly greater lens speed than marked.

**Field test slides:** Transparencies were snappy with well-rendered detail. At 35mm, corners were slightly soft, but improved greatly by f/8. Very slight barrel distortion was noticed. At 50mm and 70mm, corners slightly soft improved by one stop. Corners equalled center sharpness by f/8. Flare was well controlled throughout. At 70mm, we noted pincushion distortion. Overall, an above average performance for a 35mm to 70mm close focusing zoom.

**Optical bench analysis** (for optical experts only): On axis at 35mm, we could see very slight overcorrected spherical aberration. Very slight red flare was gone one stop down. The diffraction limit was reached by f/8. Off axis, very slight astigmatism was present mixed with very slight skew-ray flare, which was almost gone by f/11. Lateral color was present.

At 50mm, the spherical aberration was very slightly undercorrected. Very slight yellow-red flare was present but gone two stops from maximum aperture. The diffraction limit was reached by f/11. Off axis, very slight skew-ray flare could be seen mixed with very slight astigmatism. Lateral color was again present.

At 70mm, on axis, very slight undercorrected spherical aberration was present. Very slight yellow-red flare was gone again by two stops down. The diffraction limit was reached by f/11. Off axis, very slight skew-ray flare mixed with very slight coma. These were almost gone by f/16. Lateral color could be seen throughout.

## PERFORMANCE

| Our Standard                                                                                                   | as Tested                        |
|----------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Focal length: ±5%</b><br>(33.25-36.75mm)<br>(66.50-73.50mm)                                                 | 35.53mm<br>67.25mm               |
| <b>Aperture: ±5%</b><br>(f/3.33-3.68)<br>at 70 mm: (f/4.28-4.73)                                               | 1/3.21<br>1/4.58                 |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>70mm: (±2%)                                                             | 1.87% (barrel)<br>1.0% (pincshn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>70mm: (0-1.3 stops) | 0.9 stops<br>0.5 stops           |

## Interchangeable Lenses

## RESOLUTION

### OLYMPUS AF 35-70mm f/3.5-4.5 at 35mm/1:49

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 3.5 | V. Good       | 49 Excellent 44 |
| 5.6 | Excellent     | 55 Excellent 49 |
| 8   | Excellent     | 62 Excellent 55 |
| 11  | Excellent     | 55 Excellent 49 |
| 16  | V. Good       | 49 Excellent 44 |
| 22  | V. Good       | 49 Excellent 44 |

### at 50mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 3.5 | Excellent     | 50 Excellent 45 |
| 5.6 | Excellent     | 56 Excellent 50 |
| 8   | Excellent     | 63 Excellent 56 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | V. Good       | 50 Excellent 45 |
| 22  | Good          | 45 V. Good 40   |

### at 70mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4.5 | Excellent     | 56 Excellent 45 |
| 8   | Excellent     | 63 Excellent 56 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | Excellent     | 56 Excellent 50 |
| 22  | V. Good       | 50 Excellent 45 |
| 32  | V. Good       | 45 Excellent 40 |

## CONTRAST

### OLYMPUS AF 35-70mm f/3.5-4.5 at 35mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 3.5 | High       | 43 High 32   |
| 5.6 | High       | 54 High 43   |
| 8   | High       | 56 High 45   |
| 11  | High       | 47 Medium 38 |
| 16  | High       | 45 Medium 31 |
| 22  | Low        | 34 Low 29    |

### at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 3.5 | High       | 46 High 34   |
| 5.6 | High       | 56 High 42   |
| 8   | High       | 60 High 47   |
| 11  | Medium     | 46 Medium 35 |
| 16  | Medium     | 42 Medium 32 |
| 22  | Low        | 35 Low 28    |

### at 70mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 4.5 | High       | 50 High 37   |
| 8   | High       | 57 High 46   |
| 11  | High       | 60 High 48   |
| 16  | High       | 45 High 36   |
| 22  | High       | 43 Medium 33 |
| 32  | High       | 35 Medium 29 |

## FOUR PENTAX LENSES IN KA MOUNT

**Specifications:** 24mm f/2.8 Pentax-A, for Pentax K-mount bayonet; No. 5212747; accepts 52mm filters; f/2.8 to f/22 and "A", 1/2 stop detents; min. foc. dist. .79 ft. (.25m); 1 1/8 in. long, 2 3/8 in. diam. (41.5 x 63mm); 7.2 oz. (205 g); \$222.

**Specifications:** 28mm f/2.8 SMX Pentax-A in KA bayonet mount; No. 5092365, accepts 49mm accessories; f/2.8 to f/22 plus A setting with half-stop detents to f/11; full stop detents to f/22; min. foc. 1 ft. (0.3m); focusing turns clockwise 90° to inf.; 1 1/8 in. long, 2 7/16 in. diam. (37mm x 60mm) 6 oz. (170g); \$130.00



## Interchangeable Lenses

### PERFORMANCE

| Our Standard                                                                      | as Tested      |
|-----------------------------------------------------------------------------------|----------------|
| <b>Focal length:</b> ±5%<br>(22.80-25.20mm)                                       | 25.16mm        |
| <b>Aperture:</b> ±5%<br>(f/2.66-2.94)                                             | f/2.85         |
| <b>Distortion:</b><br>(±4%)                                                       | 1.13% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-3.0 stops) | 1.2 stops      |

### RESOLUTION

| PENTAX SMCP 24mm f/2.8<br>at 1:49 |                  |                  |           |    |
|-----------------------------------|------------------|------------------|-----------|----|
| f/                                | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 2.8                               | V. Good          | 49               | Excellent | 44 |
| 3.5                               | Excellent        | 69               | Excellent | 44 |
| 5.6                               | Excellent        | 78               | Excellent | 44 |
| 8                                 | Excellent        | 69               | Excellent | 49 |
| 11                                | Excellent        | 62               | Excellent | 49 |
| 16                                | V. Good          | 55               | Excellent | 44 |
| 22                                | Good             | 49               | Excellent | 44 |

### CONTRAST

| PENTAX SMCP 24mm f/2.8<br>at 30 lines/mm |               |               |      |    |
|------------------------------------------|---------------|---------------|------|----|
| f/                                       | Center<br>(%) | Corner<br>(%) |      |    |
| 2.8                                      | High          | 46            | High | 38 |
| 3.5                                      | High          | 48            | High | 40 |
| 5.6                                      | High          | 55            | High | 64 |
| 8                                        | High          | 65            | High | 62 |
| 11                                       | High          | 60            | High | 68 |
| 16                                       | High          | 61            | High | 66 |
| 22                                       | High          | 56            | High | 58 |

### PERFORMANCE

| Our Standard                                                                      | as Tested             |
|-----------------------------------------------------------------------------------|-----------------------|
| <b>Focal length:</b> ±5%<br>( 26.60-29.40mm)                                      | 28.68mm               |
| <b>Aperture:</b> ±5%<br>(f/2.66-2.94)                                             | f/2.84                |
| <b>Distortion:</b><br>(±2.5%)                                                     | less than 1% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-2.0 stops) | 1.6 stops             |

### RESOLUTION

| PENTAX A 28mm f/2.8<br>at 1: 51 |                  |                  |           |    |
|---------------------------------|------------------|------------------|-----------|----|
| f/                              | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 2.8                             | Excellent        | 57               | Excellent | 40 |
| 4                               | Excellent        | 64               | Excellent | 45 |
| 5.6                             | Excellent        | 72               | Excellent | 45 |
| 8                               | Excellent        | 64               | Excellent | 51 |
| 11                              | Excellent        | 64               | Excellent | 45 |
| 16                              | Excellent        | 57               | V. Good   | 40 |
| 22                              | Good             | 45               | Good      | 36 |

### CONTRAST

| PENTAX A 28mm f/2.8<br>at 30 lines/mm |               |               |      |    |
|---------------------------------------|---------------|---------------|------|----|
| f/                                    | Center<br>(%) | Corner<br>(%) |      |    |
| 2.8                                   | High          | 50            | High | 50 |
| 4                                     | High          | 64            | High | 56 |
| 5.6                                   | High          | 64            | High | 62 |
| 8                                     | High          | 64            | High | 63 |
| 11                                    | High          | 60            | High | 60 |
| 16                                    | High          | 56            | High | 49 |
| 22                                    | Low           | 43            | High | 42 |

### PERFORMANCE

| Our Standard                                                                      | as Tested    |
|-----------------------------------------------------------------------------------|--------------|
| <b>Focal length:</b> ±5%<br>(128.25-141.75mm)                                     | 130.09mm     |
| <b>Aperture:</b> ±5%<br>(f/2.66-2.94)                                             | f/2.91       |
| <b>Distortion:</b><br>(±2.5%)                                                     | less than 1% |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.1 stops) | 0.1 stops    |

### RESOLUTION

| PENTAX SMCP 135mm f/2.8<br>at 1: 49 |                  |                  |           |    |
|-------------------------------------|------------------|------------------|-----------|----|
| f/                                  | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 2.8                                 | Good             | 44               | Excellent | 44 |
| 4                                   | Good             | 44               | Excellent | 44 |
| 5.6                                 | Accept           | 44               | V. Good   | 44 |
| 8                                   | Good             | 49               | V. Good   | 44 |
| 11                                  | Good             | 49               | V. Good   | 44 |
| 16                                  | Good             | 49               | V. Good   | 44 |
| 22                                  | Accept           | 44               | Good      | 39 |
| 32                                  | V. Good          | 44               | Excellent | 39 |

### CONTRAST

| PENTAX SMCP 135mm f/2.8<br>at 30 lines/mm |               |               |        |    |
|-------------------------------------------|---------------|---------------|--------|----|
| f/                                        | Center<br>(%) | Corner<br>(%) |        |    |
| 2.8                                       | High          | 52            | Low    | 22 |
| 4                                         | High          | 58            | Low    | 22 |
| 5.6                                       | High          | 60            | Medium | 36 |
| 8                                         | High          | 62            | Medium | 38 |
| 11                                        | High          | 60            | Medium | 32 |
| 16                                        | High          | 60            | Medium | 32 |
| 22                                        | Low           | 35            | Low    | 30 |
| 32                                        | V. Low        | 20            | V. Low | 19 |

### PERFORMANCE

| Our Standard                                                                      | as Tested             |
|-----------------------------------------------------------------------------------|-----------------------|
| <b>Focal length:</b> ±5%<br>(285.00-315.00mm)                                     | 290.63mm              |
| <b>Aperture:</b> ±5%<br>(f/3.80-4.20)                                             | f/4.04                |
| <b>Distortion:</b><br>(±3.5%)                                                     | less than 1% (barrel) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.0 stops) | 0.6 stops             |

### RESOLUTION

| PENTAX A 300mm f/4<br>at 1: 52 |                  |                  |           |    |
|--------------------------------|------------------|------------------|-----------|----|
| f/                             | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 4                              | V. Good          | 41               | V. Good   | 33 |
| 5.6                            | V. Good          | 41               | Excellent | 37 |
| 8                              | V. Good          | 46               | Excellent | 41 |
| 11                             | Excellent        | 52               | Excellent | 46 |
| 16                             | Excellent        | 46               | Excellent | 41 |
| 22                             | V. Good          | 41               | Good      | 37 |
| 32                             | V. Good          | 37               | V. Good   | 33 |

### CONTRAST

| PENTAX A 300mm f/4<br>at 30 lines/mm |               |               |        |    |
|--------------------------------------|---------------|---------------|--------|----|
| f/                                   | Center<br>(%) | Corner<br>(%) |        |    |
| 4                                    | High          | 49            | High   | 32 |
| 5.6                                  | High          | 60            | High   | 32 |
| 8                                    | High          | 66            | Medium | 34 |
| 11                                   | High          | 62            | Low    | 31 |
| 16                                   | High          | 53            | Medium | 36 |
| 22                                   | High          | 42            | Medium | 35 |
| 32                                   | Low           | 23            | Low    | 21 |

**Specifications:** 135mm f/2.8 Pentax-A, for Pentax K-mount bayonet; No. 5008191; accepts 52mm filters; f/2.8 to f/32, ½ stop detents; min. foc. dist. 4 ft. (1.2m); 3 in. long, 2½ in. diam. (76.5 x 65 mm); 12 oz. (340 g); **\$175.00.**

**Specifications:** 300mm f/4 SMC Pentax-A in KA bayonet mount; No. 5304067, accepts 77mm accessories; f/2.8 to f/32, half-stop detents to f/16; full stop to f/32; min. foc. 13 ft. (4m); focusing turns clockwise 225° to inf.; 5½ in. long, 3¼ in. diam. (130mm x 83mm); **30 oz. (850g); \$770.00.**

**Practical comments:** "A" series is designed specifically for Super Program camera but works with all bayonet-mount Pentax cameras. 24mm f/2.8 compact, well-balanced wide-angle is about size and weight of "normal" lens; nicely finished in typical Pentax fashion; deeply knurled rubber focusing ring and ¾ in. wide aperture ring; close focus to infinity in about 90 degrees.

28mm f/2.8 features bright satin black finish, heavily knurled rubberized focusing rings, raised white mounting indicator dots, blue footage, yellow meter markings.

135mm f/2.8 has well-knurled aperture ring for auto operation; 1¼ in. wide focusing collar; built-in sliding lenshood; good finish and fine detailing.

300mm f/4 has built-in sliding lens hood, smooth focusing and aperture controls, rugged quality construction, 28mm has 7 elements in 7 groups; 300mm has 7 elements in 8 groups.

**Field test slides:** 24mm: Distortion is minimal and flare is well controlled. Center of field is sharp with some loss of sharpness evident at corners, especially at wider apertures. Above average performance overall for this type.

28mm f/2.8 produced crisp, snappy images which were well exposed by camera with crisp detail in corners, flare very well controlled.

135mm f/2.8: Sharpness good in center, softer at corners, especially at wider apertures. Average for lens of this type.

300mm f/4 provided somewhat soft images at widest aperture with the fine detail slightly lacking.

**Optical bench analysis** (for optical experts only): 24mm f/2.8: On axis, undercorrected primary photographic chromatic aberration, diffraction limited by f/8. Off axis, high coma mixed with skew-ray flare, improved at smaller apertures. No lateral color visible.

28mm f/2.8 on axis showed very slight orange flare at f/2.8 which was gone by f/5.6. The diffraction limit was reached by f/5.6. Off axis, slight skew-ray flare was nearly gone by f/5.6. There was slight lateral color throughout.

135mm f/2.8 axial: Slight overcorrected spherical aberration, slight yellow flare gone by f/16. Off axis, coma and flare gone by f/16, lateral color throughout.

300mm f/4 showed slight axial color with slight reddish yellow flare which was almost gone by f/11. Off axis, slight high order coma could be detected with slight astigmatism which was gone by f/16. Slight lateral color throughout. (January 1985)

## PAIR OF SHORT ZOOMS IN PENTAX KA MOUNT

**Specifications:** 24-50mm f/4 SMC Pentax-A in Pentax KA mount; No. 5208814; accepts

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58mm screw-in filters; f/4 to f/22 with full stop detents, half stops between f/5.6 and f/11; min. foc. dist. 16 in. (.4m); 2 $\frac{1}{2}$ -in. long, 2 $\frac{1}{2}$ -in. diam. (67.5 × 64mm); 13.2 oz. (375g); \$395.00.

**Practical comments:** Separate zooming and focusing controls;  $\frac{1}{2}$ -in. rubberized, studded focusing ring,  $\frac{3}{8}$ -in. rubberized, ribbed zoom ring; large, clear, well-defined white-on-black focal length and aperture scales, blue (feet) and yellow (meters) distance scales; smooth focus control with convenient continuous focus from infinity to minimum seating in 140°; slightly stiff zooming control makes for positive settings; compact with slightly above average heft that aids balance.

**Field test slides:** Some distortion noticeable at 24mm focal length, but well within expectations. Images somewhat soft at wider apertures at all focal lengths. Flare well controlled throughout. Although overall performance is average with this lens throughout its entire range, it is not quite up to average performance of single, fixed focal length optics.

**Optical bench analysis:** (for optical experts only): At 24mm, on axis—primary undercorrected chromatic aberration present, slight yellow flare noted by near theoretical diffraction limit by f/16. Off axis—astigmatism mixed with skew-ray flare noted. Slight lateral color present throughout aperture range.

At 35mm, on axis—slight undercorrected spherical aberration noticed, slight yellow/orange flare present but near theoretical dif-

## PERFORMANCE

| Our Standard                                                                                                   | As Tested                      |
|----------------------------------------------------------------------------------------------------------------|--------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(22.80-25.20mm)<br>(47.50-52.50mm)                                           | 24.86mm<br>48.95mm             |
| <b>Aperture:</b> $\pm 5\%$<br>(f/3.80-4.20)<br>at 50mm: (f/3.80-4.20)                                          | f/4.00<br>f/4.11               |
| <b>Distortion:</b><br>24mm: ( $\pm 4\%$ )<br>50mm: ( $\pm 1.5\%$ )                                             | 1.58% (barrel)<br>less than 1% |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>24mm: (0-3.0 stops)<br>50mm: (0-1.5 stops) | 2.0 stops<br>1.2 stops         |

## RESOLUTION

| PENTAX SMCP 24mm f/2.8<br>at 1: 49 |                  |    |                  |    |
|------------------------------------|------------------|----|------------------|----|
| f/                                 | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 2.8                                | V. Good          | 49 | Excellent        | 44 |
| 3.5                                | Excellent        | 69 | Excellent        | 44 |
| 5.6                                | Excellent        | 78 | Excellent        | 44 |
| 8                                  | Excellent        | 69 | Excellent        | 49 |
| 11                                 | Excellent        | 62 | Excellent        | 49 |
| 16                                 | V. Good          | 55 | Excellent        | 44 |
| 22                                 | Good             | 49 | Excellent        | 44 |

## CONTRAST

| PENTAX SMCP 24mm f/2.8<br>at 30 lines/mm |               |    |               |    |
|------------------------------------------|---------------|----|---------------|----|
| f/                                       | Center<br>(%) |    | Corner<br>(%) |    |
| 2.8                                      | High          | 46 | High          | 38 |
| 3.5                                      | High          | 48 | High          | 40 |
| 5.6                                      | High          | 55 | High          | 64 |
| 8                                        | High          | 65 | High          | 62 |
| 11                                       | High          | 60 | High          | 68 |
| 16                                       | High          | 61 | High          | 66 |
| 22                                       | High          | 56 | High          | 58 |

## RESOLUTION

| PENTAX SMCP 24-50mm f/4<br>at 24mm<br>at 1: 47 |                  |    |                  |    |
|------------------------------------------------|------------------|----|------------------|----|
| f/                                             | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4                                              | Excellent        | 59 | Excellent        | 33 |
| 5.6                                            | Excellent        | 67 | Excellent        | 37 |
| 8                                              | Excellent        | 67 | Excellent        | 42 |
| 11                                             | Excellent        | 59 | Excellent        | 42 |
| 16                                             | Excellent        | 59 | Excellent        | 42 |
| 22                                             | V. Good          | 47 | Excellent        | 37 |

## CONTRAST

| PENTAX SMCP 24-50mm f/4<br>at 24mm<br>at 30 lines/mm |               |    |               |    |
|------------------------------------------------------|---------------|----|---------------|----|
| f/                                                   | Center<br>(%) |    | Corner<br>(%) |    |
| 4                                                    | High          | 66 | High          | 36 |
| 5.6                                                  | High          | 64 | High          | 38 |
| 8                                                    | High          | 68 | High          | 42 |
| 11                                                   | High          | 62 | Medium        | 36 |
| 16                                                   | High          | 62 | Medium        | 36 |
| 22                                                   | High          | 50 | Medium        | 34 |

## RESOLUTION

| PENTAX SMCP 24-50mm f/4<br>at 35mm<br>at 1: 49 |                  |    |                  |    |
|------------------------------------------------|------------------|----|------------------|----|
| f/                                             | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4                                              | Excellent        | 55 | Excellent        | 39 |
| 5.6                                            | Excellent        | 62 | Excellent        | 39 |
| 8                                              | Excellent        | 62 | Excellent        | 44 |
| 11                                             | Excellent        | 62 | Excellent        | 44 |
| 16                                             | Excellent        | 55 | Excellent        | 44 |
| 22                                             | V. Good          | 49 | Excellent        | 39 |

## CONTRAST

| PENTAX SMCP 24-50mm f/4<br>at 35mm<br>at 30 lines/mm |               |    |               |    |
|------------------------------------------------------|---------------|----|---------------|----|
| f/                                                   | Center<br>(%) |    | Corner<br>(%) |    |
| 4                                                    | High          | 58 | High          | 32 |
| 5.6                                                  | High          | 59 | High          | 38 |
| 8                                                    | High          | 78 | High          | 44 |
| 11                                                   | High          | 72 | High          | 50 |
| 16                                                   | High          | 66 | High          | 45 |
| 22                                                   | High          | 54 | High          | 40 |

## RESOLUTION

| PENTAX SMCP 24-50mm f/4<br>at 50mm<br>at 1: 47 |                  |    |                  |    |
|------------------------------------------------|------------------|----|------------------|----|
| f/                                             | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4                                              | Excellent        | 59 | V. Good          | 33 |
| 5.6                                            | Excellent        | 67 | Excellent        | 42 |
| 8                                              | Excellent        | 67 | Good             | 42 |
| 11                                             | Excellent        | 67 | Good             | 37 |
| 16                                             | Excellent        | 59 | Good             | 37 |
| 22                                             | Good             | 47 | Good             | 37 |

## CONTRAST

| PENTAX SMCP 24-50mm f/4<br>at 50mm<br>at 30 lines/mm |               |    |               |    |
|------------------------------------------------------|---------------|----|---------------|----|
| f/                                                   | Center<br>(%) |    | Corner<br>(%) |    |
| 4                                                    | High          | 46 | Medium        | 24 |
| 5.6                                                  | High          | 58 | Medium        | 30 |
| 8                                                    | High          | 60 | Medium        | 34 |
| 11                                                   | High          | 52 | Medium        | 36 |
| 16                                                   | High          | 52 | High          | 40 |
| 22                                                   | Medium        | 44 | Low           | 22 |

fraction limit by f/8. Off axis—slight astigmatism mixed with skew-ray flare. Slight lateral color throughout.

At 50mm, on axis—undercorrected spherical aberration present. Slight yellow flare present but near theoretical diffraction limit by f/8. Off axis—Skew ray flare noted throughout range. Lateral color also present throughout.

**Specifications:** 35-105mm f/3.5 Pentax-A with 1:4.4 macro in Pentax A mount; No. 5254365; accepts 67mm filters; f/3.5 to f/22 with full stop detents, half stops to f/11; min. foc. dist. 5 ft. (1.5m); 3 $\frac{1}{8}$ -in. long, 2 $\frac{3}{4}$ -in. diam. (97.5 × 70mm); 21.7 oz (615g); \$305.

**Practical comments:** Separate zooming and focusing controls; large 1 $\frac{1}{2}$ -in. wide rubberized, studded focusing ring,  $\frac{3}{8}$ -in. rubberized, ribbed zoom ring; large, clear, well-defined, white-on-black focal length and aperture scale, blue (feet) and yellow (meters) distance scales; smooth focus control with short 90° turn needed for continuous focus from infinity to minimum setting; slightly stiff zoom control for positive settings with short (less than  $\frac{1}{4}$ ) turn needed to cover entire focal length range; slightly heavy but, with relatively short length, balances well on camera.

**Field test slides:** Some image softness noticeable in slides shot at wide-angle end of range. Images crisp and snappy with good detail at 50mm focal length setting. Some pin-cushion distortion found at 105mm length. Overall performance above average

## PERFORMANCE

| Our Standard                                                                                                    | As Tested                                   |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(33.25-36.75mm)<br>(99.75-110.25mm)                                           | 36.60mm<br>103.40mm                         |
| <b>Aperture:</b> $\pm 5\%$<br>(f/3.33-3.68)<br>at 105mm: (f/3.33-3.68)                                          | f/3.36<br>f/3.62                            |
| <b>Distortion:</b><br>35mm: ( $\pm 2.5\%$ )<br>105mm: ( $\pm 2.5\%$ )                                           | less than 1% (barrel)<br>1.61% (pincushion) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>105mm: (0-1.1 stops) | 1.1 stops<br>0.9 stops                      |

## RESOLUTION

| PENTAX SMCP 35-105mm f/3.5<br>at 35mm<br>at 1: 49 |                  |    |                  |    |
|---------------------------------------------------|------------------|----|------------------|----|
| f/                                                | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 3.5                                               | Excellent        | 55 | V. Good          | 31 |
| 5.6                                               | Excellent        | 62 | Excellent        | 39 |
| 8                                                 | Excellent        | 62 | Excellent        | 44 |
| 11                                                | Excellent        | 62 | Excellent        | 44 |
| 16                                                | Excellent        | 55 | Excellent        | 39 |
| 22                                                | V. Good          | 49 | Excellent        | 44 |

## CONTRAST

| PENTAX SMCP 35-105mm f/3.5<br>at 35mm<br>at 30 lines/mm |               |    |               |    |
|---------------------------------------------------------|---------------|----|---------------|----|
| f/                                                      | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                                     | High          | 50 | High          | 32 |
| 5.6                                                     | High          | 58 | High          | 48 |
| 8                                                       | High          | 60 | High          | 48 |
| 11                                                      | High          | 60 | High          | 44 |
| 16                                                      | High          | 58 | High          | 43 |
| 22                                                      | High          | 52 | Low           | 22 |



## Interchangeable Lenses

### RESOLUTION

| PENTAX SMCP 35-105mm f/3.5<br>at 50mm<br>at 1: 50 |                  |    |                  |    |
|---------------------------------------------------|------------------|----|------------------|----|
| f/                                                | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 3.5                                               | Excellent        | 56 | V. Good          | 32 |
| 5.6                                               | Excellent        | 56 | Excellent        | 40 |
| 8                                                 | Excellent        | 63 | Excellent        | 50 |
| 11                                                | Excellent        | 56 | Excellent        | 50 |
| 16                                                | Excellent        | 56 | Excellent        | 50 |
| 22                                                | V. Good          | 50 | Excellent        | 45 |

### CONTRAST

| PENTAX SMCP 35-105mm f/3.5<br>at 50mm<br>at 30 lines/mm |                 |    |                 |    |
|---------------------------------------------------------|-----------------|----|-----------------|----|
| f/                                                      | Center<br>( % ) |    | Corner<br>( % ) |    |
| 3.5                                                     | High            | 46 | Medium          | 26 |
| 5.6                                                     | High            | 60 | High            | 42 |
| 8                                                       | High            | 64 | High            | 49 |
| 11                                                      | High            | 66 | High            | 50 |
| 16                                                      | High            | 56 | High            | 49 |
| 22                                                      | Medium          | 42 | Medium          | 33 |

### RESOLUTION

| PENTAX SMCP 35-105mm f/3.5<br>at 105mm<br>at 1: 50 |                  |    |                  |    |
|----------------------------------------------------|------------------|----|------------------|----|
| f/                                                 | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 3.5                                                | Excellent        | 50 | Excellent        | 40 |
| 5.6                                                | Excellent        | 56 | Excellent        | 45 |
| 8                                                  | Excellent        | 63 | Excellent        | 45 |
| 11                                                 | Excellent        | 56 | Excellent        | 50 |
| 16                                                 | V. Good          | 50 | Excellent        | 45 |
| 22                                                 | Excellent        | 56 | Excellent        | 40 |

### CONTRAST

| PENTAX SMCP 35-105mm f/3.5<br>at 105mm<br>at 30 lines/mm |                 |    |                 |    |
|----------------------------------------------------------|-----------------|----|-----------------|----|
| f/                                                       | Center<br>( % ) |    | Corner<br>( % ) |    |
| 3.5                                                      | High            | 40 | Medium          | 27 |
| 5.6                                                      | High            | 52 | High            | 34 |
| 8                                                        | High            | 60 | Medium          | 38 |
| 11                                                       | High            | 62 | High            | 40 |
| 16                                                       | High            | 58 | Medium          | 32 |
| 22                                                       | High            | 50 | V. Low          | 23 |

for wide-angle-to-telephoto lens in this focal length range.

**Optical bench analysis:** (for optical experts only): At 35mm, on axis—primary undercorrected chromatic aberration at maximum aperture, near theoretical diffraction limit on f/stop down. Slight yellow flare present, near theoretical diffraction limit by f/5.6. Off axis—slight skew-ray flare noted, but near theoretical diffraction limit by f/8. Lateral color noted throughout range.

At 50mm, on axis—primary undercorrected chromatic aberration near theoretical diffraction limit by f/8. Slight yellow flare but almost at theoretical diffraction limit by f/5.6. Off axis—slight astigmatism and skew ray flare, near theoretical diffraction limit by f/8. Lateral color present at all apertures.

At 105mm, on axis—slight secondary telephoto aberration at maximum aperture, improved at smaller apertures. Slight yellow flare noted, near theoretical diffraction limit by f/16. Off axis—slight astigmatism mixed with skew ray flare throughout aperture range. Slight lateral color at all apertures. (April 1984)

## 75-200mm f/2.8-3.5 QUANTARAY ZOOM

**Specifications:** 75-200mm f/2.8-3.5 Quantaray Zoom, No. 1000246; mounts for Canon, Konica, Minolta, Nikon, Olympus, Pentax; accepts 67mm filters; f/2.8 (3.5) to f/22; detents at all full stops; min. foc. dist. 4 ft. (1.2m); 1:4.5 magnification; 5 1/4-in. long, 2 3/4 in. diam. (130 X 70mm), 1 lb. 7 oz. (657g); \$209.95.

**Practical comments:** Single touch (combined zoom and focusing collar) continuously focusing to macro at 200mm; smooth zooming action but no collar creep; very wide 2 1/4 in. diamond-studded, rubberized zoom/focus collar goes smoothly from infinity to minimum distance setting in 200 degrees clockwise turn; all controls operate smoothly and quickly but ribbed aperture setting ring is somewhat stiff; large, legible white-on-black numerals (green footage scale markings); shiny black finish.

**Field test slides:** Slides were generally crisp and snappy. At 75mm, image quality at center was slightly soft at maximum aperture, but improved at f/4. Small amount of color fringing noticeable in corners but gone by f/5.6. Slight barrel distortion noted at 75mm. At 135mm slides were slightly soft in corners, but image sharpness improved noticeably by f/5.6, and corner sharpness was equal to center sharpness. Performance at 200mm similar to that at 135mm. Slight pin-cushion distortion apparent at 200mm. Flare

### PERFORMANCE

| Our Standard                                                      |  | as Tested                         |  |
|-------------------------------------------------------------------|--|-----------------------------------|--|
| <b>Focal length: ±5%</b><br>(71.25- 78.75mm)<br>(190.00-210.00mm) |  | 78.54mm<br>206.12mm               |  |
| <b>Aperture: ±5%</b><br>(f/2.66-2.94)<br>at 200mm: (f/3.33-3.68)  |  | f/2.91<br>f/3.52                  |  |
| <b>Distortion:</b><br>75mm: (±2%)<br>200mm (±2.5%)                |  | 0.95% (barrel)<br>0.94% (pinchsn) |  |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit  |  |                                   |  |
| 75mm: (0-1.2 stops)                                               |  | 0.6 stops                         |  |
| 200mm: (0-1.0 stops)                                              |  | 0.8 stops                         |  |

### RESOLUTION

| QUANTARAY 75-200mm f/2.8-3.5<br>at 75mm<br>at 1:51 |                  |    |                  |    |
|----------------------------------------------------|------------------|----|------------------|----|
| f/                                                 | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 2.8                                                | Good             | 40 | Excellent        | 36 |
| 4                                                  | Good             | 45 | Excellent        | 40 |
| 5.6                                                | Good             | 51 | Excellent        | 45 |
| 8                                                  | Good             | 51 | Excellent        | 45 |
| 11                                                 | Excellent        | 57 | Excellent        | 51 |
| 16                                                 | Excellent        | 57 | Excellent        | 51 |
| 22                                                 | Excellent        | 57 | Excellent        | 51 |

### CONTRAST

| QUANTARAY 75-200mm f/2.8-3.5<br>at 75mm<br>at 30 lines/mm |                 |    |                 |    |
|-----------------------------------------------------------|-----------------|----|-----------------|----|
| f/                                                        | Center<br>( % ) |    | Corner<br>( % ) |    |
| 2.8                                                       | Medium          | 39 | Medium          | 28 |
| 4                                                         | High            | 42 | Medium          | 31 |
| 5.6                                                       | High            | 50 | Medium          | 39 |
| 8                                                         | High            | 59 | High            | 46 |
| 11                                                        | High            | 53 | High            | 40 |
| 16                                                        | High            | 44 | Medium          | 32 |
| 22                                                        | Low             | 33 | Low             | 28 |

### RESOLUTION

| QUANTARAY 75-200mm f/2.8-3.5<br>at 135mm<br>at 1:51 |                  |    |                  |    |
|-----------------------------------------------------|------------------|----|------------------|----|
| f/                                                  | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 2.8                                                 | V. Good          | 45 | Excellent        | 40 |
| 4                                                   | V. Good          | 51 | Excellent        | 45 |
| 5.6                                                 | Good             | 51 | Excellent        | 45 |
| 8                                                   | V. Good          | 57 | Excellent        | 51 |
| 11                                                  | Excellent        | 57 | Excellent        | 51 |
| 16                                                  | V. Good          | 51 | Excellent        | 45 |
| 22                                                  | V. Good          | 51 | Excellent        | 45 |

### CONTRAST

| QUANTARAY 75-200mm f/2.8-3.5<br>at 135mm<br>at 30 lines/mm |                 |    |                 |    |
|------------------------------------------------------------|-----------------|----|-----------------|----|
| f/                                                         | Center<br>( % ) |    | Corner<br>( % ) |    |
| 2.8                                                        | Medium          | 38 | Medium          | 27 |
| 4                                                          | High            | 41 | Medium          | 30 |
| 5.6                                                        | Medium          | 49 | Medium          | 39 |
| 8                                                          | High            | 59 | High            | 45 |
| 11                                                         | High            | 52 | High            | 41 |
| 16                                                         | High            | 42 | Medium          | 32 |
| 22                                                         | Medium          | 34 | Low             | 29 |

### RESOLUTION

| QUANTARAY 75-200mm f/2.8-3.5<br>at 200mm<br>at 1:51 |                  |    |                  |    |
|-----------------------------------------------------|------------------|----|------------------|----|
| f/                                                  | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 3.5                                                 | Excellent        | 51 | Excellent        | 45 |
| 5.6                                                 | Excellent        | 51 | Excellent        | 45 |
| 8                                                   | Excellent        | 57 | Excellent        | 51 |
| 11                                                  | Excellent        | 57 | Excellent        | 51 |
| 16                                                  | Excellent        | 51 | Excellent        | 45 |
| 22                                                  | Excellent        | 51 | Excellent        | 45 |

### CONTRAST

| QUANTARAY 75-200mm f/2.8-3.5<br>at 200mm<br>at 30 lines/mm |                 |    |                 |    |
|------------------------------------------------------------|-----------------|----|-----------------|----|
| f/                                                         | Center<br>( % ) |    | Corner<br>( % ) |    |
| 3.5                                                        | Medium          | 39 | Medium          | 29 |
| 5.6                                                        | High            | 45 | High            | 34 |
| 8                                                          | High            | 59 | High            | 46 |
| 11                                                         | High            | 51 | High            | 40 |
| 16                                                         | High            | 42 | Medium          | 31 |
| 22                                                         | Low             | 32 | Low             | 27 |

well controlled throughout. Overall an average-to-slightly-above-average lens for this type.

**Optical bench analysis** (for optical experts only): At 75mm: on axis, slight undercorrected spherical aberration and slight axial color noted. Diffraction limited by f/8. Off axis, slight coma mixed with slight skew ray flare evident. Lateral color present.

At 135mm, on axis, slight undercorrected spherical aberration, slight axial color noted. Diffraction limited by f/8. Off axis, slight skew-ray flare mixed with slight astigmatism. Lateral color evident.

At 200mm, on axis, slight red flare present but gone by two stops down from maximum aperture. Slight undercorrected spherical aberration observed. Diffraction limited by f/8. Off axis, slight skew-ray flare mixed with slight astigmatism present. Lateral color noted. (March 1986)

## 28mm f/2.8 RIKENON IN K-R LENS MOUNT

**Specifications:** 28mm f/2.8 Rikenon; no. 104668 in Ricoh K-R mount, accepts 52mm



accessories; f/2.8 to f/16 plus locked P setting with full stop detents; min. foc. dist. 1 ft. (0.3m); 1 5/8 in. long, 2 3/8 in. diam. (43 x 60mm) 6 15/16 oz. (197g) \$142.00.

**Practical comments:** Nicely finished, well-engraved standard optic in new K-R mount offering full automation on Ricoh XR-P camera as well as operating with all K mount cameras, focusing clockwise.

**Field test slides:** Crisp and snappy. At full aperture, a small amount of edge sharpness falloff was noticeable but was gone by f/4. Centers were all sharp and detailed with corners becoming equal to edges by f/5.6. Flare was well controlled throughout. Only minimum color fringing in the corners of slides was visible. Average performance for this type of lens.

#### PERFORMANCE

| Our Standard                                                                      | as Tested |
|-----------------------------------------------------------------------------------|-----------|
| <b>Focal length:</b> ±5%<br>(26.60-29.40mm)                                       | 28.67mm   |
| <b>Aperture:</b> ±5%<br>(f/2.66-2.94)                                             | f/2.86    |
| <b>Distortion:</b><br>(±2.5%)                                                     | under 1%  |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-2.0 stops) | 0.8 stops |

#### RESOLUTION

| RIKENON P 28mm f/2.8<br>at 1:50 |                  |    |                  |    |
|---------------------------------|------------------|----|------------------|----|
| f/                              | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 2.8                             | Excellent        | 63 | Excellent        | 50 |
| 4                               | Excellent        | 63 | Excellent        | 50 |
| 5.6                             | Excellent        | 70 | Excellent        | 50 |
| 8                               | Excellent        | 70 | Excellent        | 50 |
| 11                              | Excellent        | 63 | Excellent        | 50 |
| 16                              | Excellent        | 56 | Excellent        | 45 |

#### CONTRAST

| RIKENON P 28mm f/2.8<br>at 30 lines/mm |               |    |               |    |
|----------------------------------------|---------------|----|---------------|----|
| f/                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 2.8                                    | High          | 64 | High          | 56 |
| 4                                      | High          | 63 | High          | 58 |
| 5.6                                    | High          | 73 | High          | 60 |
| 8                                      | High          | 74 | High          | 59 |
| 11                                     | High          | 71 | High          | 50 |
| 16                                     | High          | 51 | High          | 45 |

### 35-70mm f/3.5-4.5 RIKENON ZOOM

**Optical bench analysis** (for optical experts only): On axis, slightly over-corrected spherical aberration could be seen with very slight axial color which was gone by f/5.6. Diffraction limited by f/8. Off axis, very slight skew ray flare was visible mixed with slight astigmatism. Lateral color could be seen throughout. (November 1984)

**Specifications:** 35-70mm f/3.5-4.5 Rikenon in Ricoh XR (modified K) mount; No. 111705; accepts 55mm filters; f/3.5-f/22 (f/4.5-22 at 70mm) with full stop detents except between f/3.5 and f/5.6; min. foc. dist. 35 in. (0.9m); 12 3/4-in. (0.3m); 1:6 magnification in "macro" mode; 3-in. long, 2 1/2-in. diam. 76 x 63mm; 11 1/2 oz. (330g). \$230.

**Practical comments:** Lens is moderately compact, medium weight for this focal length range; smooth operating rubberized

#### PERFORMANCE

| Our Standard                                                                                                   | as Tested                          |
|----------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length:</b> ±5%<br>(33.25-36.75mm)<br>(66.50-73.50mm)                                                 | 36.30mm<br>68.17mm                 |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 70mm: (f/4.28-4.73)                                                | f/3.59<br>f/4.62                   |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>70mm: (±2%)                                                             | 0.95% (barrel)<br>0.48% (pincushn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>70mm: (0-1.3 stops) | 1.0 stops<br>0.3 stops             |

#### RESOLUTION

| RIKENON 35-70mm f/3.5-4.5<br>at 35mm<br>at 1:49 |                      |    |                      |    |
|-------------------------------------------------|----------------------|----|----------------------|----|
| f/                                              | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 3.5                                             | V. Good              | 49 | Excellent            | 44 |
| 5.6                                             | V. Good              | 49 | Excellent            | 44 |
| 8                                               | V. Good              | 55 | Excellent            | 49 |
| 11                                              | Excellent            | 62 | Excellent            | 55 |
| 16                                              | Excellent            | 55 | Excellent            | 49 |
| 22                                              | V. Good              | 49 | Excellent            | 44 |

#### CONTRAST

| RIKENON 35-70mm f/3.5-4.5<br>at 35mm<br>at 30 lines/mm |            |    |            |    |
|--------------------------------------------------------|------------|----|------------|----|
| f/                                                     | Center (%) |    | Corner (%) |    |
| 3.5                                                    | High       | 44 | High       | 33 |
| 5.6                                                    | High       | 56 | High       | 45 |
| 8                                                      | High       | 62 | High       | 50 |
| 11                                                     | High       | 57 | High       | 46 |
| 16                                                     | High       | 46 | Medium     | 34 |
| 22                                                     | Low        | 34 | Medium     | 30 |

#### RESOLUTION

| RIKENON 35-70mm f/3.5-4.5<br>at 50mm<br>at 1:50 |                      |    |                      |    |
|-------------------------------------------------|----------------------|----|----------------------|----|
| f/                                              | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                                               | Excellent            | 50 | Excellent            | 45 |
| 5.6                                             | Excellent            | 56 | Excellent            | 50 |
| 8                                               | V. Good              | 56 | Excellent            | 50 |
| 11                                              | Excellent            | 63 | Excellent            | 56 |
| 16                                              | Excellent            | 56 | Excellent            | 50 |
| 22                                              | V. Good              | 50 | Excellent            | 45 |

#### CONTRAST

| RIKENON 35-70mm f/3.5-4.5<br>at 50mm<br>at 30 lines/mm |            |    |            |    |
|--------------------------------------------------------|------------|----|------------|----|
| f/                                                     | Center (%) |    | Corner (%) |    |
| 4                                                      | High       | 49 | High       | 39 |
| 5.6                                                    | High       | 58 | High       | 47 |
| 8                                                      | High       | 61 | High       | 50 |
| 11                                                     | High       | 56 | High       | 48 |
| 16                                                     | Medium     | 47 | Medium     | 36 |
| 22                                                     | Low        | 33 | Low        | 29 |

#### MACRO RESOLUTION

| RIKENON 35-70mm f/3.5-4.5<br>at 70mm<br>at 1:4 |                      |    |                      |    |
|------------------------------------------------|----------------------|----|----------------------|----|
| f/                                             | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                            | Accept               | 36 | Excellent            | 32 |
| 5.6                                            | Accept               | 40 | Excellent            | 36 |
| 8                                              | Accept               | 45 | Excellent            | 40 |
| 11                                             | Good                 | 45 | Excellent            | 40 |
| 16                                             | Accept               | 40 | V. Good              | 36 |
| 22                                             | Accept               | 40 | V. Good              | 36 |

### Interchangeable Lenses

#### RESOLUTION

| RIKENON 35-70mm f/3.5-4.5<br>at 70mm<br>at 1:50 |                      |    |                      |    |
|-------------------------------------------------|----------------------|----|----------------------|----|
| f/                                              | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                             | Excellent            | 50 | Excellent            | 45 |
| 5.6                                             | Excellent            | 56 | Excellent            | 50 |
| 8                                               | V. Good              | 56 | Excellent            | 50 |
| 11                                              | Excellent            | 63 | Excellent            | 56 |
| 16                                              | Excellent            | 56 | Excellent            | 50 |
| 22                                              | V. Good              | 50 | Excellent            | 45 |

#### CONTRAST

| RIKENON 35-70mm f/3.5-4.5<br>at 70mm<br>at 30 lines/mm |            |    |            |    |
|--------------------------------------------------------|------------|----|------------|----|
| f/                                                     | Center (%) |    | Corner (%) |    |
| 4.5                                                    | High       | 50 | High       | 37 |
| 5.6                                                    | High       | 58 | High       | 46 |
| 8                                                      | High       | 63 | High       | 51 |
| 11                                                     | High       | 54 | High       | 44 |
| 16                                                     | High       | 46 | High       | 38 |
| 22                                                     | Medium     | 34 | Medium     | 30 |

rings for two-touch control; "macro" reached by pushing small button on zoom ring and turning beyond 70mm setting.

**Field test slides:** Transparencies were crisp and snappy with detail well rendered. At all focal lengths, center sharpness equalled corner sharpness by 2 stops down from maximum aperture. Some color fringing was noted in the corners with lens wide open. Also at 35mm, some barrel distortion was evident. Light falloff was gone by f/5.6. Macro quality was average. Overall performance average for this type of lens.

**Optical bench analysis** (for optical experts): At 35mm, on axis, very slight overcorrected spherical aberration. Diffraction limited pattern by f/11. Off axis, very slight skew-ray flare mixed with slight astigmatism was present. Lateral color present.

At 50mm, on axis, very slight over-corrected spherical aberration. Axial color was gone by f/8. Diffraction limit was reached by f/11. Off axis, slight skew-ray flare mixed with slight coma. Lateral color was evident.

At 70mm, on axis, very slight over-corrected spherical aberration with slight yellow flare, which disappeared by f/8. Diffraction limited pattern by f/11. Off axis, slight high order coma with astigmatism. Lateral color present. (June 1986)

### 70-210mm F/3.9 RIKENON ZOOM

**Specifications:** 70-210mm f/3.9 Rikenon P Zoom; R K bayonet mount for Ricoh XRP; and other cameras taking K-mount lenses; No. 001368; accepts 58mm filters; f/3.9 to f/32, plus P, full stop detents; min. foc. dist. 4 ft. (1.2m); max. magnification 1:4 at 70mm; 5 5/8 in. long, 2 3/8 in. diam. (148 x 71mm); 1 lb. 9 oz. (705g); \$330.00

**Practical comments:** Solid, well-finished one-touch 3:1 zoom, focusing to 4 ft. and to 1:4 magnification at 70mm. Rubber-covered 2 1/2 in. focusing ring was free of slippage with lens pointed down; apertures, focal length, and metric scales color-coded white; footage, macro magnifications and P (programmed auto) settings in green. Filters and attachments rotate during focus. Focuses and stops down clockwise to infinity (viewed from rear); pulls back for longer focal lengths.



## Interchangeable Lenses

**Field test slides:** Slides generally crisp with well-rendered detail. Wide-open, at all focal lengths, centers appeared a bit soft. Performance uniformly sharp by f/5.6. Flare well-controlled. Slight fall-off in illumination wide-

open at all focal-lengths. Good quality macro performance at middle apertures.

**Optical bench analysis:** (for optical experts only): On axis at 70mm, slight over-corrected spherical with primary chromatic aberration, gone by f/8. Diffraction limited by f/8. At 135mm, slight over-corrected spherical, and secondary tele aberration, gone by f/8. Diffraction limited by f/11. At 210mm, slight secondary telephoto aberration, gone by f/8; diffraction limited by f/11. Off axis at 70mm, slight coma, gone by f/8. Lateral color throughout. At 135mm, slight coma and astigmatism, lateral color throughout. At 210mm, slight skew-ray flare and astigmatism to f/8, lateral color throughout. (September 1984)

### PERFORMANCE

| Our Standard                                                                                                    | as Tested                            |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------------|
| <b>Focal length:</b> ±5%<br>(66.50-73.50mm)<br>(199.50-220.50mm)                                                | 72.59mm<br>205.12mm                  |
| <b>Aperture:</b> ±5%<br>(f/3.71-4.09)<br>at 210mm: (f/3.71-4.09)                                                | f/4.01<br>f/4.02                     |
| <b>Distortion:</b><br>70mm: (±2%)<br>210mm: (±3.5%)                                                             | under 1% (barrel)<br>2.39% (pinchsn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.0 stops) | 0.5 stops<br>1.0 stops               |

### RESOLUTION

| RIKENON 70-210mm f/3.9<br>at 70mm<br>at 1: 50 |                  |    |                  |    |
|-----------------------------------------------|------------------|----|------------------|----|
| f/                                            | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.9                                           | Excellent        | 56 | Excellent        | 50 |
| 5.6                                           | Excellent        | 63 | Excellent        | 50 |
| 8                                             | Excellent        | 63 | Excellent        | 50 |
| 11                                            | Excellent        | 63 | Excellent        | 56 |
| 16                                            | Excellent        | 56 | Excellent        | 50 |
| 22                                            | V. Good          | 50 | Excellent        | 45 |
| 32                                            | V. Good          | 45 | Excellent        | 40 |

### CONTRAST

| RIKENON 70-210mm f/3.9<br>at 70mm<br>at 30 lines/mm |               |    |               |    |
|-----------------------------------------------------|---------------|----|---------------|----|
| f/                                                  | Center<br>(%) |    | Corner<br>(%) |    |
| 3.9                                                 | High          | 59 | Medium        | 30 |
| 5.6                                                 | High          | 68 | High          | 34 |
| 8                                                   | High          | 71 | High          | 40 |
| 11                                                  | High          | 65 | High          | 39 |
| 16                                                  | High          | 64 | High          | 37 |
| 22                                                  | High          | 56 | Medium        | 35 |
| 32                                                  | High          | 50 | High          | 34 |

### RESOLUTION

| RIKENON 70-210mm f/3.9<br>at 135mm<br>at 1: 49 |                  |    |                  |    |
|------------------------------------------------|------------------|----|------------------|----|
| f/                                             | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.9                                            | Excellent        | 55 | Excellent        | 44 |
| 5.6                                            | Excellent        | 62 | Excellent        | 49 |
| 8                                              | V. Good          | 62 | Excellent        | 49 |
| 11                                             | V. Good          | 55 | Excellent        | 44 |
| 16                                             | Good             | 49 | Excellent        | 44 |
| 22                                             | Good             | 49 | Excellent        | 44 |
| 32                                             | V. Good          | 44 | Excellent        | 39 |

### CONTRAST

| RIKENON 70-210mm f/3.9<br>at 135mm<br>at 30 lines/mm |               |    |               |    |
|------------------------------------------------------|---------------|----|---------------|----|
| f/                                                   | Center<br>(%) |    | Corner<br>(%) |    |
| 3.9                                                  | High          | 60 | Medium        | 30 |
| 5.6                                                  | High          | 69 | High          | 32 |
| 8                                                    | High          | 71 | High          | 40 |
| 11                                                   | High          | 66 | High          | 37 |
| 16                                                   | High          | 64 | Medium        | 35 |
| 22                                                   | High          | 55 | Medium        | 34 |
| 32                                                   | High          | 51 | High          | 30 |

### RESOLUTION

| RIKENON 70-210mm f/3.9<br>at 210mm<br>at 1: 49 |                  |    |                  |    |
|------------------------------------------------|------------------|----|------------------|----|
| f/                                             | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.9                                            | Excellent        | 49 | Excellent        | 39 |
| 5.6                                            | Excellent        | 55 | Excellent        | 44 |
| 8                                              | Excellent        | 62 | Excellent        | 49 |
| 11                                             | Excellent        | 62 | Excellent        | 49 |
| 16                                             | Excellent        | 55 | Excellent        | 44 |
| 22                                             | Excellent        | 49 | Excellent        | 44 |
| 32                                             | Excellent        | 44 | Excellent        | 39 |

### CONTRAST

| RIKENON 70-210mm f/3.9<br>at 210mm<br>at 30 lines/mm |               |    |               |    |
|------------------------------------------------------|---------------|----|---------------|----|
| f/                                                   | Center<br>(%) |    | Corner<br>(%) |    |
| 3.9                                                  | High          | 60 | High          | 31 |
| 5.6                                                  | High          | 68 | High          | 33 |
| 8                                                    | High          | 70 | High          | 41 |
| 11                                                   | High          | 66 | High          | 39 |
| 16                                                   | High          | 63 | Medium        | 35 |
| 22                                                   | High          | 55 | Medium        | 33 |
| 32                                                   | High          | 50 | Medium        | 29 |

### MACRO RESOLUTION

| RIKENON 70-210mm f/3.9<br>at 70mm<br>at 1: 4 |                  |    |                  |    |
|----------------------------------------------|------------------|----|------------------|----|
| f/                                           | Center<br>(l/mm) |    | Corner<br>(l/mm) |    |
| 3.9                                          | ***              | 34 | Good             | 27 |
| 5.6                                          | ***              | 38 | Good             | 30 |
| 8                                            | Good             | 48 | Accept           | 30 |
| 11                                           | Good             | 48 | Accept           | 30 |
| 16                                           | Good             | 48 | Accept           | 30 |
| 22                                           | Accept           | 43 | Accept           | 30 |
| 32                                           | Good             | 38 | Good             | 27 |

\*\*\*Aperture not normally recommended for macro photography.

## 28-135mm f/3.5-4.5 VIVITAR VARIFOCA

**Specifications:** 28-135mm f/3.5-4.5 Macro Focusing Vivitar Zoom, No.09508155, mounts for Nikon, Canon, Pentax, Minolta, Olympus, Yashica/Contax; accepts 67mm accessories; f/3.5-22, full stop detents; min. foc. dist.: 8 in. (0.7m) throughout zoom range; 1:2.7X macro at 28mm focal length; 4½ in. long, 2¾ in. diam. (115 x 70mm); 23½ oz. (665g). \$297.95.

**Practical comments:** Single touch varifocal zoom (requires refocusing when focal length is changed) focuses clockwise 100° continuously and smoothly to macro at 8

inches and 28mm. All markings legible, but no depth-of-field scale, 2 in. wide rubberized focusing and zooming collar, moderately light, easy to handle; smooth satin finish.

**Field test slides:** Generally crisp and snappy images with fine detail well rendered at all focal lengths. Slight light fall-off noticed at 28mm and f/3.5 but gone by f/5.6. Slightly soft wide open at 50mm and 135mm but sharp by f/8. Flare well controlled throughout with macro quality impressive, especially at middle apertures. Overall, an above average lens of this type.

**Optical bench analysis** (for optical experts only): At 28mm, on axis, slight overcorrected spherical aberration was seen with very slight axial color, gone by f/8. Diffraction limited by f/11. Off axis, very slight skew-ray flare mixed with very slight coma; some lateral color.

At 50mm, on axis, same comments as at 28mm. Off axis, very slight coma mixed with slight astigmatism; some lateral color.

At 135mm, on axis, slight overcorrected spherical aberration with slight axial color, gone by f/8. Diffraction limited by f/16. Off axis, very slight skew-ray flare mixed with very slight astigmatism; some lateral color.

### PERFORMANCE

| Our Standard                                                                                                    | as Tested                  |
|-----------------------------------------------------------------------------------------------------------------|----------------------------|
| <b>Focal length:</b> ±5%<br>( 26.60- 29.40mm)<br>(128.25-141.75mm)                                              | 29.20mm<br>134.05mm        |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 135mm: (f/4.28-4.73)                                                | f/3.52<br>f/4.67           |
| <b>Distortion:</b><br>28mm: (±2.5%)<br>135mm: (±2.5%)                                                           | under 1%<br>0.45 (pinchsn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>28mm: (0-2.0 stops)<br>135mm: (0-1.1 stops) | 1.0 stops<br>0.7 stops     |

### RESOLUTION

| VIVITAR 28-135mm f/3.5-4.5<br>at 28mm/1:49 |               |    |               |    |
|--------------------------------------------|---------------|----|---------------|----|
| f/                                         | Center (l/mm) |    | Corner (l/mm) |    |
| 3.5                                        | V. Good       | 49 | Excellent     | 44 |
| 5.6                                        | Excellent     | 55 | Excellent     | 49 |
| 8                                          | Excellent     | 62 | Excellent     | 55 |
| 11                                         | Excellent     | 62 | Excellent     | 55 |
| 16                                         | Excellent     | 55 | Excellent     | 49 |
| 22                                         | Excellent     | 55 | Excellent     | 49 |

### at 50mm/1:49

| f/  | Center (l/mm) |    | Corner (l/mm) |    |
|-----|---------------|----|---------------|----|
| 4   | V. Good       | 49 | Excellent     | 44 |
| 5.6 | V. Good       | 55 | Excellent     | 62 |
| 8   | V. Good       | 62 | Excellent     | 55 |
| 11  | Excellent     | 62 | Excellent     | 55 |
| 16  | V. Good       | 55 | Excellent     | 49 |
| 22  | V. Good       | 55 | Excellent     | 49 |

### at 135mm/1:50

| f/  | Center (l/mm) |    | Corner (l/mm) |    |
|-----|---------------|----|---------------|----|
| 4.5 | Excellent     | 56 | Excellent     | 50 |
| 8   | Excellent     | 63 | Excellent     | 56 |
| 11  | Excellent     | 63 | Excellent     | 56 |
| 16  | Excellent     | 56 | Excellent     | 50 |
| 22  | Excellent     | 56 | Excellent     | 50 |

### MACRO RESOLUTION

| at 28mm/1:4 |               |    |               |    |
|-------------|---------------|----|---------------|----|
| f/          | Center (l/mm) |    | Corner (l/mm) |    |
| 3.5         | V. Good       | 45 | Excellent     | 29 |
| 5.6         | Excellent     | 51 | Excellent     | 29 |
| 8           | Excellent     | 57 | Excellent     | 36 |
| 11          | Excellent     | 51 | Excellent     | 36 |
| 16          | Excellent     | 51 | Excellent     | 36 |
| 22          | Good          | 40 | Excellent     | 36 |



## CONTRAST

### at 28mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 3.5 | High       | 45 High    |
| 5.6 | High       | 56 High    |
| 8   | High       | 64 High    |
| 11  | High       | 60 High    |
| 16  | High       | 56 High    |
| 22  | Medium     | 41 Medium  |

### at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4   | High       | 47 High    |
| 5.6 | High       | 58 High    |
| 8   | High       | 63 High    |
| 11  | High       | 58 High    |
| 16  | High       | 54 High    |
| 22  | Medium     | 40 Medium  |

### at 135mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4.5 | High       | 49 High    |
| 8   | High       | 55 High    |
| 11  | High       | 65 High    |
| 16  | High       | 59 High    |
| 22  | High       | 44 Medium  |

## 75-300mm AUTOFOCUS SIGMA FOR MAXXUMS

**Specifications:** 75-300mm f/4.5-5.6 Sigma Zoom AF No. 1003346 in Minolta A bayonet mount, accepts 55mm accessories, f/4.5 to f/22 set electronically by camera, min. foc. dist. 5 ft. (1.5m), macro 1:4 at 300mm, 5-1/2 in. long, 3 in. diam. (143x75mm); 25 oz. (709g), \$435.

**Practical comments:** Ruggedly made, nicely finished; clear, readable numerals, push-pull zoom with easily grippable 2 in.-wide rubberized zoom collar continuous focusing to macro, narrow but easily turnable knurled and rubberized manual front focusing ring. Depth-of-field scale at footage window only applicable for 75mm focal length. Scale on lens barrel indicates relative depth-of-field narrowing only. Time required to autofocus from infinity to closest focus point was 1.9 sec. at 300mm and 1.5 sec. at 75mm, on Maxxum 7000.

**Field Test Slides:** Overall crisp and snappy with well-rendered detail. At 75mm and f/4.5, corners were slightly soft. By f/8, corners of the slides almost equalled center sharpness. Performance at 200mm and 300mm was very similar, with some pincushion distortion noted in slides at 300mm. Flare was well controlled throughout. Slides shot at 1:4 macro had average quality, which improved as the lens was stopped down. From the slides, we judged the macro capabilities of the lens to be about average. Overall, the slides revealed slightly above average performance for a lens of this type.

**Optical bench analysis** (for optical experts only): On axis at 75mm, we detected very slight overcorrected spherical aberration with very slight axial color, which was gone by f/8. Diffraction limit was reached by f/11. Off axis, very slight coma mixed with very slight astigmatism plus some lateral color.

At 200mm on axis, very slight overcorrected spherical aberration with very slight axial color gone by f/11. The diffraction limit was reached by f/16. Off axis, very slight coma was found mixed with very slight astigmatism and lateral color.

On axis at 300mm, we could see very slight overcorrected spherical aberration with slight red flare gone by f/11. The diffraction limit was reached by f/16. Off axis, very slight skew-ray flare and the latter mixed with very slight astigmatism.

## PERFORMANCE

| Our Standard                                                                                                    | as Tested                          |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length:</b> $\pm 5\%$<br>(71.25-78.75mm)<br>(285.00-315.00mm)                                          | 77.47mm<br>297.08mm                |
| <b>Aperture:</b> $\pm 5\%$<br>(f/4.28-4.73)<br>at 300mm: (f/5.32-5.88)                                          | f/4.71<br>f/5.68                   |
| <b>Distortion:</b><br>75mm: ( $\pm 2\%$ )<br>300mm: ( $\pm 3.5\%$ )                                             | 0.46% (barrel)<br>2.53% (pincushn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>75mm: (0-1.2 stops)<br>300mm: (0-1.0 stops) | 0.6 stops<br>0.8 stops             |

## RESOLUTION

### SIGMA 75-300mm f/4.5-5.6 at 75mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4.5 | Excellent     | 50 Excellent  |
| 5.6 | Excellent     | 56 Excellent  |
| 8   | Excellent     | 63 Excellent  |
| 11  | Excellent     | 70 Excellent  |
| 16  | Excellent     | 63 Excellent  |
| 22  | Excellent     | 56 Excellent  |

### at 200mm/1:50

| f/ | Center (l/mm) | Corner (l/mm) |
|----|---------------|---------------|
| 5  | Excellent     | 50 Excellent  |
| 8  | Excellent     | 56 Excellent  |
| 11 | Excellent     | 63 Excellent  |
| 16 | Excellent     | 56 Excellent  |
| 22 | Excellent     | 50 Excellent  |

### at 300mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 5.6 | Excellent     | 50 Excellent  |
| 8   | Excellent     | 56 Excellent  |
| 11  | Excellent     | 56 Excellent  |
| 16  | Excellent     | 50 Excellent  |
| 22  | Excellent     | 45 Excellent  |

## MACRO RESOLUTION

### SIGMA 75-300mm f/4.5-5.6 at 300mm/1:4

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 5.6 | V. Good       | 39 Excellent  |
| 8   | Excellent     | 44 Excellent  |
| 11  | V. Good       | 44 V. Good    |
| 16  | Good          | 39 Good       |
| 22  | Good          | 39 Good       |

## CONTRAST

### SIGMA 75-300mm f/4.5-5.6 at 75mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4.5 | High       | 48 High    |
| 5.6 | High       | 55 High    |
| 8   | High       | 61 High    |
| 11  | High       | 56 High    |
| 16  | High       | 50 High    |
| 22  | Medium     | 39 Low     |

### at 200mm/30 lines/mm

| f/ | Center (%) | Corner (%) |
|----|------------|------------|
| 5  | High       | 48 High    |
| 8  | High       | 59 High    |
| 11 | High       | 61 High    |
| 16 | High       | 52 High    |
| 22 | High       | 40 Medium  |

## Interchangeable Lenses

### at 300mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 5.6 | High       | 51 High    |
| 8   | High       | 61 High    |
| 11  | High       | 55 High    |
| 16  | High       | 45 Medium  |
| 22  | Medium     | 36 Low     |

## SUMMILUX f/1.4 50mm

Continued from page 122

## RESOLUTION

### SUMMILUX 50mm f/1.4 at 1:51

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 1.4 | V. Good       | 51 Excellent  |
| 2   | V. Good       | 57 Excellent  |
| 2.8 | Good          | 57 Good       |
| 4   | V. Good       | 64 V. Good    |
| 5.6 | Excellent     | 72 Excellent  |
| 8   | Excellent     | 72 Excellent  |
| 11  | Excellent     | 72 Excellent  |
| 16  | Excellent     | 64 Excellent  |

## CONTRAST

### SUMMILUX 50mm f/1.4 at 30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 1.4 | High       | 49 High    |
| 2   | High       | 56 High    |
| 2.8 | High       | 60 High    |
| 4   | High       | 64 High    |
| 5.6 | High       | 69 High    |
| 8   | High       | 70 High    |
| 11  | High       | 65 High    |
| 16  | High       | 62 High    |

## COMPACT ONE-TOUCH 35-200mm SIGMA

**Specifications:** 35-200mm f/4.5-5.6 Sigma, No. 1003032; in mounts for Canon, Fujica, Konica, Minolta, Nikon, Olympus, Pentax universal thread, Pentax, Ricoh, Rollei, Yashica/Contax; accepts 62mm filters; f/4 (5.6) to f/22; detents stops at 1/2 stop intervals; min. foc. dist.: 5.9 ft. (1.8m) in normal focus range at all focal lengths, to 1:3.7 in macro at 200mm setting; 4 1/2-in. long, 2 1/2-in. diam. (114 x 63mm); 1 lb. 2 oz. (521g); \$379.90.

**Practical comments:** Small and lightweight for its remarkably long 5.5:1 zooming range, due in part to its moderate f/4-5.6 aperture. Generous 2 1/2-in. wide, textured rubber-studded zoom/focus ring takes the lens down to its minimum normal focus range smoothly in a 120° turn. Pushing same ring forward 1 5/8-in. zooms from 35mm to 200mm setting at which point the ring can be turned to the macro range by focusing the lens closer. Marked macro settings in orange-on-black range from 1:5 to 1:3.7. White-on-black metric distance, aperture, depth-of-field scales and focal length settings are clear and legible; green-on-black footage scale is harder to read in dim light. Fine satin-black finish; smooth, swift focus and zoom action; zoom settings do not slip even when lens is held vertically.

**Field test slides:** Test transparencies crisp and snappy at all focal lengths with detail



# Interchangeable Lenses

## PERFORMANCE

| Our Standard                                                                                                            | as Tested                       |
|-------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>Focal length: <math>\pm 5\%</math></b><br>(33.25-36.75mm)<br>(190.00-210.00mm)                                       | 36.60mm<br>198.72mm             |
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/3.80-4.20)<br>at 200mm: (f/5.32-5.88)                                       | f/4.15<br>f/5.74                |
| <b>Distortion:</b><br>35mm: ( $\pm 2.5\%$ )<br>200mm: ( $\pm 2.5\%$ )                                                   | 1.36% (barrel)<br>0.91% (pinch) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>at f/8, 200mm: (0-1.0 stops) | 1.2 stops<br>0.7 stops          |

## RESOLUTION

| SIGMA 35-200mm f/4-5.6<br>at 35mm at 1:49 |                      |                      |           |    |
|-------------------------------------------|----------------------|----------------------|-----------|----|
| f/                                        | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 4                                         | V. Good              | 49                   | Excellent | 44 |
| 5.6                                       | Excellent            | 55                   | Excellent | 49 |
| 8                                         | Excellent            | 62                   | Excellent | 55 |
| 11                                        | Excellent            | 55                   | Excellent | 49 |
| 16                                        | V. Good              | 49                   | Excellent | 44 |
| 22                                        | V. Good              | 49                   | Excellent | 44 |

## CONTRAST

| SIGMA 35-200mm f/4-5.6<br>at 35mm<br>at 30 lines/mm |            |            |        |    |
|-----------------------------------------------------|------------|------------|--------|----|
| f/                                                  | Center (%) | Corner (%) |        |    |
| 4                                                   | High       | 46         | High   | 36 |
| 5.6                                                 | High       | 56         | High   | 45 |
| 8                                                   | High       | 65         | High   | 53 |
| 11                                                  | High       | 67         | High   | 56 |
| 16                                                  | High       | 54         | High   | 42 |
| 22                                                  | Medium     | 42         | Medium | 32 |

## RESOLUTION

| SIGMA 35-200mm f/4-5.6<br>at 100mm at 1:50 |                      |                      |           |    |
|--------------------------------------------|----------------------|----------------------|-----------|----|
| f/                                         | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 5.3                                        | Excellent            | 50                   | Excellent | 45 |
| 8                                          | Excellent            | 56                   | Excellent | 50 |
| 11                                         | Excellent            | 63                   | Excellent | 56 |
| 16                                         | Excellent            | 56                   | Excellent | 50 |
| 22                                         | V. Good              | 50                   | Excellent | 45 |
| 32                                         | V. Good              | 45                   | Excellent | 40 |

## CONTRAST

| SIGMA 35-200mm f/4-5.6<br>at 100mm<br>at 30 lines/mm |            |            |      |    |
|------------------------------------------------------|------------|------------|------|----|
| f/                                                   | Center (%) | Corner (%) |      |    |
| 5.3                                                  | High       | 54         | High | 43 |
| 8                                                    | High       | 61         | High | 49 |
| 11                                                   | High       | 64         | High | 52 |
| 16                                                   | High       | 58         | High | 47 |
| 22                                                   | High       | 48         | High | 40 |
| 32                                                   | High       | 39         | High | 32 |

## RESOLUTION

| SIGMA 35-200mm f/4-5.6<br>at 200mm at 1:50 |                      |                      |           |    |
|--------------------------------------------|----------------------|----------------------|-----------|----|
| f/                                         | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |           |    |
| 5.6                                        | Excellent            | 50                   | Excellent | 45 |
| 8                                          | Excellent            | 56                   | Excellent | 50 |
| 11                                         | Excellent            | 63                   | Excellent | 56 |
| 16                                         | Excellent            | 56                   | Excellent | 50 |
| 22                                         | Excellent            | 50                   | Excellent | 45 |
| 32                                         | Excellent            | 50                   | Excellent | 45 |

## CONTRAST

| SIGMA 35-200mm f/4-5.6<br>at 200mm<br>at 30 lines/mm |            |            |      |    |
|------------------------------------------------------|------------|------------|------|----|
| f/                                                   | Center (%) | Corner (%) |      |    |
| 5.6                                                  | High       | 58         | High | 43 |
| 8                                                    | High       | 64         | High | 51 |
| 11                                                   | High       | 69         | High | 52 |
| 16                                                   | High       | 57         | High | 46 |
| 22                                                   | High       | 47         | High | 38 |
| 32                                                   | High       | 40         | High | 31 |

## MACRO RESOLUTION

| SIGMA 35-200mm f/4-5.6<br>at 200mm at 1:4 |                      |                      |         |    |
|-------------------------------------------|----------------------|----------------------|---------|----|
| f/                                        | Center<br>(Lines/mm) | Corner<br>(Lines/mm) |         |    |
| 5.6                                       | Accept               | 29                   | Accept  | 25 |
| 8                                         | Good                 | 32                   | V. Good | 29 |
| 11                                        | Good                 | 36                   | Good    | 32 |
| 16                                        | V. Good              | 40                   | V. Good | 36 |
| 22                                        | Good                 | 36                   | Good    | 32 |
| 32                                        | V. Good              | 36                   | V. Good | 32 |

well rendered. At 35mm setting corner sharpness equalled center by f/8. Slight color fringing noticeable in corners at maximum aperture. Barrel distortion noted. At 100mm sharpness increased overall by f/8. Very minimal pincushion distortion noticeable. At 200mm sharpness increased by f/8. Pincushion distortion evident. Flare well controlled throughout. Macro quality acceptable at middle apertures. Overall, a slightly above average lens for its type.

**Optical bench analysis** (for optical experts only): At 35mm, on axis, very slight under-corrected spherical aberration. Very slight red flare, gone by f/8. Diffraction limited pattern by f/11. Off axis, slight coma mixed with slight skew-ray flare. Lateral color visible. At 100mm, on axis, very slight under-corrected spherical aberration. Very slight yellow/red flare, gone by f/8. Diffraction limited pattern by f/11. Off axis, slight skew-ray flare mixed with slight astigmatism. Lateral color noted.

At 200mm, on axis, very slight over-corrected spherical aberration. Very slight axial color, gone by f/8. Diffraction limited pattern by f/16. Off axis, slight coma mixed with very slight astigmatism. Lateral color present. (March 1986)

## SIGMA's 70-210mm AF ZOOM

**Specifications:** 70-210mm f/3.5-4.5 Sigma AF-APO, No. 2003094 in Minolta Maxxum mount accepts 52mm accessories; f/3.5 to f/22; min. foc. dist.: 1.5 foot (0.6m). Also available in Nikon, Yashica and Pentax AF mounts; 12 elements in 9 groups; 2 3/4 x 4 7/8 inches (72x125.5mm); 1 pound 8 5/16 ounces (689g). \$523.

**Comments:** Lens has gray-green, almost camouflage-type barrel, with a wide, non-integral black rubber band-type grip. Zoom is push/pull. Autofocus is quick; manual focus can be accomplished smoothly with a little practice, using the thin, black, serrated plastic focusing ring at the front of the lens. Manual focusing is undamped. There is no aperture ring.

## PERFORMANCE

| Our Standard                                                                                                    | As Tested                    |
|-----------------------------------------------------------------------------------------------------------------|------------------------------|
| <b>Focal length: <math>\pm 5\%</math></b><br>(66.50-73.50mm)<br>(199.50-220.50mm)                               | 70.91mm<br>204.66mm          |
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/3.33-3.68)<br>at 210mm: (f/4.28-4.73)                               | f/3.51<br>f/4.72             |
| <b>Distortion:</b><br>70mm: ( $\pm 2\%$ )<br>210mm: ( $\pm 3.5\%$ )                                             | 1.4% (pinch)<br>1.9% (pinch) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.0 stops) | -2 stops<br>-4 stops         |

## RESOLUTION

| Sigma APO 70-210mm f/3.5-4.5<br>at 70mm/1:50 |               |               |           |    |
|----------------------------------------------|---------------|---------------|-----------|----|
| f/                                           | Center (l/mm) | Corner (l/mm) |           |    |
| 3.5                                          | Excellent     | 56            | Excellent | 45 |
| 5.6                                          | Excellent     | 63            | Excellent | 50 |
| 8                                            | Excellent     | 63            | Excellent | 56 |
| 11                                           | Excellent     | 70            | Excellent | 56 |
| 16                                           | Excellent     | 63            | Excellent | 50 |
| 22                                           | Excellent     | 56            | Excellent | 50 |

## at 150mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |           |    |
|-----|---------------|---------------|-----------|----|
| 4   | Excellent     | 56            | Excellent | 45 |
| 5.6 | Excellent     | 63            | Excellent | 50 |
| 8   | Excellent     | 70            | Excellent | 56 |
| 11  | Excellent     | 63            | Excellent | 56 |
| 16  | Excellent     | 56            | Excellent | 50 |
| 22  | Excellent     | 50            | Excellent | 45 |

## at 210mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |           |    |
|-----|---------------|---------------|-----------|----|
| 4.5 | Excellent     | 56            | Excellent | 45 |
| 5.6 | Excellent     | 63            | Excellent | 50 |
| 8   | Excellent     | 70            | Excellent | 56 |
| 11  | Excellent     | 63            | Excellent | 56 |
| 16  | Excellent     | 56            | Excellent | 50 |
| 22  | Excellent     | 50            | Excellent | 45 |
| 32  | Excellent     | 50            | Excellent | 45 |

## CONTRAST

| at 70mm/30 lines/mm |            |            |      |    |
|---------------------|------------|------------|------|----|
| f/                  | Center (%) | Corner (%) |      |    |
| 3.5                 | High       | 55         | High | 48 |
| 5.6                 | High       | 56         | High | 52 |
| 8                   | High       | 64         | High | 53 |
| 11                  | High       | 58         | High | 55 |
| 16                  | High       | 52         | High | 51 |
| 22                  | High       | 46         | High | 36 |

## at 150mm/30 lines/mm

| f/  | Center (%) | Corner (%) |      |    |
|-----|------------|------------|------|----|
| 4   | High       | 54         | High | 47 |
| 5.6 | High       | 65         | High | 48 |
| 8   | High       | 66         | High | 50 |
| 11  | High       | 62         | High | 50 |
| 16  | High       | 55         | High | 46 |
| 22  | High       | 50         | High | 41 |



at 210mm/30 lines/mm

| f/  | Center (%) | Medium | Corner (%) |
|-----|------------|--------|------------|
| 4.5 | High       | 56     | 22         |
| 5.6 | High       | 64     | 23         |
| 8   | High       | 64     | 28         |
| 11  | High       | 61     | 35         |
| 16  | High       | 58     | 30         |
| 22  | High       | 48     | 28         |
| 32  | High       | 38     | 24         |

When the lens is held at anything more than a slight angle, up or down, the lens barrel has a tendency to "creep" slightly to or from the longer focal length settings. A raised red dot aligns the bayonet mount. Depth-of-field scale and focal length markings are applied, not engraved, onto the lens barrel. Distance indicator, in meters and feet, set behind window at front of lens.

**Field test slides:** Our slides were crisp and snappy with well-rendered detail throughout. At 70mm, there was very slight color fringing in the corners, which was gone by f/4.5. Corners equalled center sharpness by f/8. Very slight pincushion distortion was noticed. Light falloff noted wide open was gone by f/5.6. At 150mm, corners equalled center sharpness by f/8. Light falloff wide open was gone by one stop. At 210mm, corners were slightly soft at widest aperture, but corners equalled center sharpness by f/8. Very slight pincushion distortion was noted. Light falloff wide open was gone by one stop down. Flare was well controlled throughout all focal lengths. An above-average performance for this type of autofocus zoom.

**Optical bench analysis:** At 70mm, on-axis, slight undercorrected spherical aberration with slight flare, gone by f/4.5. Diffraction limited by f/16. Off-axis, very slight skew-ray flare, almost gone by f/16. Lateral color noted.

At 150mm, on-axis, very slight overcorrected spherical aberration. Diffraction limited by f/16. Off-axis, very slight astigmatism mixed with very slight skew-ray almost gone by f/16. Lateral color noted.

210mm, on-axis, very slight overcorrected spherical aberration with very slight red flare gone by f/8. Diffraction limited by f/16. Off-axis, very slight skew-ray flare mixed with very slight astigmatism almost gone by f/16. Lateral color noted.

## 28-70mm/70-210mm TAMRON ZOOMS

**Specifications:** 28-70mm f/3.5-4.5 Tamron CF Macro. No.630619 in Tamron Adaptall-2 interchangeable mounts for Canon, Minolta MD, Konica, Yashica/Contax, Olympus, Pentax K and ES, M-42 Universal thread, Nikon AI, Fujica AX and ST, Mamiya ZE, Leica R4, Rollei, Topcon, Praktica B and LLC; accepts 58mm accessories, f/3.5-4.5 to f/32 (at AE); half-stop detents; min. foc. dist.: 12 in. (0.3m) at 70mm; 3 in. long, 12 $\frac{3}{4}$  oz. (361g). \$206 with case, Adaptall-2 mounts, \$31 additional; Leica mount, \$64 extra.

**Specifications:** 70-210mm f/3.8-4 Tamron. No.5201368 in Tamron Adaptall-2 interchangeable mounts as listed above, f/3.8-4 to f/32; half-stop detents; min. foc. dist: 35 in. (0.9m) at all focal lengths, to 1:2.9 magnification at 210mm; 5 $\frac{3}{4}$  in. long, 2 $\frac{5}{8}$  in. diam.

(143.9x66mm); 20 oz. (580g). \$215 with case; Adaptall-2 mounts extra as listed above.

**Practical comments:** Both lenses are very well finished in satin black, with legible apertures in white, and red AE mark at f/32 position, clear white-on-black metric and pale green footage scales.

The 28-70 Tamron is a moderate sized two-touch lens with grippably textured, 1 $\frac{1}{16}$  in. wide focusing collar at the front of the barrel, which turns clockwise only 60° to get to 27 in. (0.7m) minimum distance in normal range at 28mm setting. To select full macro range, turn knurled  $\frac{1}{16}$  in. wide zoom ring at rear of lens clockwise to orange 70mm setting, and focusing ring will now turn 90° further clockwise to 1 ft. min. dist. in orange-numbered macro range. The farther you turn zoom ring off 28mm to longer focal length settings, the closer you can focus—e.g. min. foc. dist. at 50mm setting is about 1 $\frac{1}{3}$  ft. Both focus and zoom rings operate very smoothly and hold settings well. Lens balances nicely on small, medium and large-sized SLRs. Effective apertures are color coded with dual aperture-index lines in orange (for 70mm setting) and blue (for 28mm), with matching infrared index lines for these focal lengths. Three lugs on front ring accept optional bayonet lens mount.

The 70-210mm Tamron is an average-size, single-touch tele zoom with a very wide (2 $\frac{1}{2}$  in.) zoom/focus collar that focuses to min. dist. in a smooth 120° clockwise turn, zooms from 210 down to 70mm with very smooth 1 $\frac{5}{8}$  in. forward push. Orange macro mark below distance scales works in conjunction with straightforward system of curvilinear magnification scales engraved on barrel; marked focal lengths of 70, 85, 105, 135, and 210mm; single aperture scale and index satisfactory given very small change (f/3.8-4) of variable aperture. Lens has good feel and very good balance on most SLRs.

**Field test slides:** The 28-70mm generally produced crisp, snappy transparencies with fine details well rendered. At 28mm wide open, some softness was noted, and center-to-corner sharpness was noticeably improved at one stop down. A similar pattern was observed at 50mm, with some barrel distortion also present. At 70mm, corner images were slightly soft wide open and significantly improved by f/5.6. Flare was well controlled throughout, but could cause lack of contrast at 70mm when shooting directly against a strong light source. Overall, somewhat above average performance for this type of zoom.

The 70-210mm also delivered crisp, snappy transparencies overall. However, at 70mm, corner images wide open were slightly soft, with corners equalling center sharpness by f/5.6. Very slight barrel distortion was also noted. At 135mm, very slight color fringing was observed in corners of slides shot at the two widest apertures, but was absent in those shot 2 stops down. At 135mm, corners equalled center sharpness by f/5.6. At 210mm, slight pincushion distortion was observed, with corner and center sharpness equal by 1 stop down. Flare well controlled throughout. Macro performance judged above average for a zoom of this type. Overall, average to above average performance.

**Optical bench analysis** (for optical experts only): the 28-70mm Tamron, on axis at 28mm, showed slight overcorrected spherical aberration with very slight flare gone by

## Interchangeable Lenses

f/5.6, diffraction-limited pattern by f/16. Off axis at 28mm, very slight skewray flare, almost gone by f/11, mixed with very slight astigmatism. Some lateral color was present. At 50mm on axis, very slight overcorrected spherical aberration; very slight yellow flare gone by f/8; diffraction-limited pattern by f/16. Off axis at 50mm, very slight skew-ray flare with very slight astigmatism to f/11. Minimal lateral color.

At 70mm on axis, slight overcorrected spherical aberration, very slight red-yellow flare gone by f/8. Diffraction-limited by f/16. At 70mm off axis, very slight skew-ray flare with very slight coma, almost gone by f/11, some lateral color.

The 70-210mm Tamron, on axis at 70mm, showed very slight undercorrected spherical aberration and slight primary chromatic aberration, gone by f/8. Diffraction-limited pattern by f/16. At 70mm off axis, slight coma with very slight astigmatism, almost gone by f/16.

At 135mm on axis, very slight undercorrected spherical aberration; slight flare and primary chromatic aberration, gone by f/8. Diffraction-limited by f/16. At 135mm off axis, very slight coma mixed with very slight astigmatism, gone by f/16. Minimal lateral color.

At 210mm on axis, very slight undercorrected spherical aberration. Very slight primary chromatic aberration gone by f/11. Diffraction-limited by f/16. Off axis at 200mm, very slight coma mixed with very slight astigmatism, gone by f/16. Some lateral color present.

## PERFORMANCE

| Our Standard                                                                                                    | as Tested                         |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Focal length: <math>\pm 5\%</math></b><br>( 26.60- 29.40mm)<br>( 66.50- 73.50mm)                             | 28.98mm<br>66.95mm                |
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/3.33-3.68)<br>at 70mm: (f/4.28-4.73)                                | f/3.52<br>f/4.61                  |
| <b>Distortion:</b><br>28mm: ( $\pm 2.5\%$ )<br>70mm: ( $\pm 2\%$ )                                              | 2.62% (barrel)<br>0.45% (pincshn) |
| <b>Light falloff: at f/5.6</b><br>+ 1 stop from theoretical limit<br>28mm: (0-2.0 stops)<br>70mm: (0-1.3 stops) | 0.7 stops<br>0.6 stops            |

## RESOLUTION

### TAMRON 28-70mm f/3.5-4.5 at 28mm/1:49

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 3.5 | V. Good       | 49 Excellent  |
| 5.6 | Excellent     | 55 Excellent  |
| 8   | Excellent     | 62 Excellent  |
| 11  | Excellent     | 62 Excellent  |
| 16  | Excellent     | 55 Excellent  |
| 22  | V. Good       | 49 Excellent  |

### at 50mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4   | Excellent     | 56 Excellent  |
| 5.6 | Excellent     | 63 Excellent  |
| 8   | Excellent     | 70 Excellent  |
| 11  | Excellent     | 63 Excellent  |
| 16  | Excellent     | 56 Excellent  |
| 22  | V. Good       | 50 Excellent  |

### at 70mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4.5 | Excellent     | 56 Excellent  |
| 5.6 | Excellent     | 63 Excellent  |
| 8   | Excellent     | 63 Excellent  |
| 11  | Excellent     | 70 Excellent  |
| 16  | Excellent     | 63 Excellent  |
| 22  | Excellent     | 56 Excellent  |



## Interchangeable Lenses

### MACRO RESOLUTION

| at 70mm/1:4 |               |               |    |
|-------------|---------------|---------------|----|
| f/          | Center (l/mm) | Corner (l/mm) |    |
| 4.5         | Accept        | 36 Excellent  | 32 |
| 5.6         | Accept        | 40 Excellent  | 36 |
| 8           | Accept        | 45 V. Good    | 36 |
| 11          | Good          | 45 Excellent  | 40 |
| 16          | Accept        | 40 V. Good    | 36 |
| 22          | Accept        | 40 Good       | 32 |

### CONTRAST

| at 28mm/30 lines/mm |            |            |    |
|---------------------|------------|------------|----|
| f/                  | Center (%) | Corner (%) |    |
| 3.5                 | High       | 46 High    | 33 |
| 5.6                 | High       | 56 High    | 44 |
| 8                   | High       | 58 High    | 45 |
| 11                  | High       | 57 High    | 42 |
| 16                  | High       | 45 Medium  | 34 |
| 22                  | Medium     | 39 Medium  | 30 |

### at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%) |    |
|-----|------------|------------|----|
| 4   | High       | 48 High    | 36 |
| 5.6 | High       | 58 High    | 46 |
| 8   | High       | 60 High    | 49 |
| 11  | High       | 61 High    | 50 |
| 16  | High       | 50 Medium  | 40 |
| 22  | Medium     | 41 Low     | 29 |

### at 70mm/30 lines/mm

| f/  | Center (%) | Corner (%) |    |
|-----|------------|------------|----|
| 4.5 | High       | 50 High    | 39 |
| 5.6 | High       | 58 High    | 48 |
| 8   | High       | 60 High    | 49 |
| 11  | High       | 61 High    | 49 |
| 16  | High       | 49 High    | 39 |
| 22  | Medium     | 39 Low     | 29 |

### PERFORMANCE

| Our Standard                                                                                                    |  | as Tested                         |  |
|-----------------------------------------------------------------------------------------------------------------|--|-----------------------------------|--|
| <b>Focal length: ±5%</b><br>(66.50-73.50mm)<br>(199.50-220.50mm)                                                |  | 72.44mm<br>209.24mm               |  |
| <b>Aperture: ±5%</b><br>(f/3.61-3.99)<br>at 210mm: (f/3.80-4.20)                                                |  | f/3.99<br>f/4.19                  |  |
| <b>Distortion:</b><br>70mm: (±2%)<br>210mm: (±3.5%)                                                             |  | 1.32% (barrel)<br>1.86% (pincshn) |  |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.0 stops) |  | 0.6 stops<br>0.6 stops            |  |

### RESOLUTION

#### TAMRON 70-210mm f/3.8-4 at 70mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |    |
|-----|---------------|---------------|----|
| 3.8 | Excellent     | 50 Excellent  | 45 |
| 5.6 | Excellent     | 56 Excellent  | 50 |
| 8   | Excellent     | 63 Excellent  | 56 |
| 11  | Excellent     | 63 Excellent  | 50 |
| 16  | Excellent     | 56 Excellent  | 50 |
| 22  | Excellent     | 56 Excellent  | 50 |

### at 135mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |    |
|-----|---------------|---------------|----|
| 3.8 | Excellent     | 50 Excellent  | 45 |
| 5.6 | Excellent     | 56 Excellent  | 50 |
| 8   | Excellent     | 63 Excellent  | 50 |
| 11  | Excellent     | 63 Excellent  | 56 |
| 16  | Excellent     | 56 Excellent  | 50 |
| 22  | Excellent     | 56 Excellent  | 50 |

### at 210mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |    |
|-----|---------------|---------------|----|
| 4   | Excellent     | 50 Excellent  | 45 |
| 5.6 | Excellent     | 56 Excellent  | 50 |
| 8   | Excellent     | 56 Excellent  | 50 |
| 11  | Excellent     | 63 Excellent  | 56 |
| 16  | Excellent     | 56 Excellent  | 50 |
| 22  | Excellent     | 50 Excellent  | 45 |

### MACRO RESOLUTION

| at 210mm/1:4 |               |               |    |
|--------------|---------------|---------------|----|
| f/           | Center (l/mm) | Corner (l/mm) |    |
| 4            | Good          | 32 V. Good    | 29 |
| 5.6          | V. Good       | 36 Excellent  | 32 |
| 8            | Good          | 40 V. Good    | 36 |
| 11           | Excellent     | 45 V. Good    | 36 |
| 16           | V. Good       | 40 Good       | 32 |
| 22           | Good          | 36 Good       | 32 |

### CONTRAST

| at 70mm/30 lines/mm |            |            |    |
|---------------------|------------|------------|----|
| f/                  | Center (%) | Corner (%) |    |
| 3.8                 | Medium     | 39 Medium  | 30 |
| 5.6                 | High       | 45 High    | 40 |
| 8                   | High       | 56 High    | 45 |
| 11                  | High       | 58 High    | 46 |
| 16                  | High       | 57 Medium  | 44 |
| 22                  | Medium     | 39 Medium  | 30 |

### at 135mm/30 lines/mm

| f/  | Center (%) | Corner (%) |    |
|-----|------------|------------|----|
| 3.8 | High       | 42 High    | 35 |
| 5.6 | High       | 50 High    | 44 |
| 8   | High       | 54 High    | 48 |
| 11  | High       | 56 High    | 52 |
| 16  | High       | 50 High    | 42 |
| 22  | High       | 40 Medium  | 32 |

### at 210mm/30 lines/mm

| f/  | Center (%) | Corner (%) |    |
|-----|------------|------------|----|
| 4   | High       | 43 High    | 33 |
| 5.6 | High       | 48 High    | 38 |
| 8   | High       | 54 High    | 42 |
| 11  | High       | 56 High    | 45 |
| 16  | High       | 51 High    | 42 |
| 22  | High       | 41 Medium  | 31 |

## WIDE TO TELE SOLIGOR ZOOM

**Specifications:** 35-200mm f/3.5-4.8 Soligor C/D, No. 6841220060; mounts to fit Pentax KA, Universal M-42 thread, Nikon, Canon, Minolta MD, Konica, Olympus, Fujica AX, Yashica/Contax, Ricoh XR; accepts 67mm filters; f/3.5 to f/22 and "A"; full stop detents throughout; min. foc. dist.: 5.2 ft. (1.6m) normal; 11.8 in. (30cm) macro (at 1:4); focuses to infinity in 90°; 5-in. long, 2 3/4 in. diam. (126mm x 70mm); 22.9 oz. (650g); \$149.50.

**Practical comments:** Wide (2 1/8-in.), rubberized one-touch zoom/focus control collar, separate locking ring for macro mode; 1/8-in. knurled aperture ring with locking "A" position; fully auto diaphragm; smoothly finished; controls function quickly in use, but zoom collar "creeps" when lens is held in up or down position; has 16 elements in 13 groups.

**Field test slides:** At 35mm, corners slightly soft wide open, but equalled center sharp-

### PERFORMANCE

| Our Standard                                                                                                    |  | as Tested                             |  |
|-----------------------------------------------------------------------------------------------------------------|--|---------------------------------------|--|
| <b>Focal length: ±5%</b><br>(33.25-36.75mm)<br>(190.00-210.00mm)                                                |  | 35.53mm<br>199.17mm                   |  |
| <b>Aperture: ±5%</b><br>(f/3.33-3.68)<br>at 200mm: (f/4.56-5.04)                                                |  | f/3.46<br>f/5.02                      |  |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>200mm (±2.5%)                                                            |  | under 1% (pincshn)<br>2.31% (pincshn) |  |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>200mm: (0-1.0 stops) |  | 1.0 stops<br>0.8 stops                |  |

ness one stop down; minimal falloff at 35mm wide open. At 100mm and 200mm, slides were sharp and contrasty, with some softness in corners wide open. Flare was well

### RESOLUTION

| SOLIGOR 35-200mm f/3.5-4.8<br>at 35mm<br>at 1:49 |               |               |    |
|--------------------------------------------------|---------------|---------------|----|
| f/                                               | Center (l/mm) | Corner (l/mm) |    |
| 3.5                                              | V. Good       | 49 Excellent  | 44 |
| 5.6                                              | Excellent     | 55 Excellent  | 49 |
| 8                                                | Excellent     | 69 Excellent  | 55 |
| 11                                               | Excellent     | 69 Excellent  | 55 |
| 16                                               | Excellent     | 62 Excellent  | 55 |
| 22                                               | Excellent     | 55 Excellent  | 49 |

### CONTRAST

| SOLIGOR 35-200mm f/3.5-4.8<br>at 35mm<br>at 30 lines/mm |            |            |    |
|---------------------------------------------------------|------------|------------|----|
| f/                                                      | Center (%) | Corner (%) |    |
| 3.5                                                     | High       | 62 High    | 40 |
| 5.6                                                     | High       | 66 High    | 42 |
| 8                                                       | High       | 70 High    | 52 |
| 11                                                      | High       | 69 High    | 54 |
| 16                                                      | High       | 62 High    | 42 |
| 22                                                      | High       | 50 Medium  | 32 |

### RESOLUTION

| SOLIGOR 35-200mm f/3.5-4.8<br>at 100mm<br>at 1:50 |               |               |    |
|---------------------------------------------------|---------------|---------------|----|
| f/                                                | Center (l/mm) | Corner (l/mm) |    |
| 3.5                                               | Excellent     | 50 Excellent  | 45 |
| 5.6                                               | Excellent     | 56 Excellent  | 50 |
| 8                                                 | Excellent     | 63 Excellent  | 56 |
| 11                                                | Excellent     | 70 Excellent  | 56 |
| 16                                                | Excellent     | 63 Excellent  | 56 |
| 22                                                | Excellent     | 56 Excellent  | 50 |

### CONTRAST

| SOLIGOR 35-200mm f/3.5-4.8<br>at 100mm<br>at 30 lines/mm |            |            |    |
|----------------------------------------------------------|------------|------------|----|
| f/                                                       | Center (%) | Corner (%) |    |
| 3.5                                                      | High       | 58 High    | 32 |
| 5.6                                                      | High       | 60 High    | 49 |
| 8                                                        | High       | 69 High    | 52 |
| 11                                                       | High       | 67 High    | 53 |
| 16                                                       | High       | 59 High    | 41 |
| 22                                                       | High       | 49 Medium  | 31 |

### RESOLUTION

| SOLIGOR 35-200mm f/3.5-4.8<br>at 200mm<br>at 1:51 |               |               |    |
|---------------------------------------------------|---------------|---------------|----|
| f/                                                | Center (l/mm) | Corner (l/mm) |    |
| 4.8                                               | Excellent     | 51 Excellent  | 45 |
| 5.6                                               | Excellent     | 57 Excellent  | 51 |
| 8                                                 | Excellent     | 64 Excellent  | 57 |
| 11                                                | Excellent     | 72 Excellent  | 64 |
| 16                                                | Excellent     | 64 Excellent  | 57 |
| 22                                                | Excellent     | 57 Excellent  | 51 |

### CONTRAST

| SOLIGOR 35-200mm f/3.5-4.8<br>at 200mm<br>at 30 lines/mm |            |            |    |
|----------------------------------------------------------|------------|------------|----|
| f/                                                       | Center (%) | Corner (%) |    |
| 4.8                                                      | High       | 57 High    | 44 |
| 5.6                                                      | High       | 59 High    | 50 |
| 8                                                        | High       | 68 High    | 51 |
| 11                                                       | High       | 64 High    | 49 |
| 16                                                       | High       | 57 High    | 41 |
| 22                                                       | Low        | 34 Low     | 29 |



controlled throughout. Overall, an above average performer for a wide-to-long tele zoom.

**Optical bench analysis** (for optical experts only): At 35mm, on axis, slightly overcorrected spherical aberration with very slight axial astigmatism, diffraction limited by f/11; off axis, very slight high order coma mixed with very slight skew ray flare and lateral color. At 100mm, slight, undercorrected spherical aberration with very slight axial astigmatism, diffraction limited by f/11 on axis; off axis, slight skew ray flare mixed with slight astigmatism. At 200mm, slight undercorrected spherical aberration on axis, with very slight red flare, diffraction limited by f/11; off axis, same as 100mm.

(February 1986)

## SOLIGOR 70-210mm MACRO ZOOM

**Specifications:** 70-210mm f/4.5 Soligor C/D zoom; No. 184024890; mounts for Pentax KA, Universal M-42 thread, Nikon, Canon, Minolta MD, Konica, Olympus, Fujica AX, Yashica/Contax, Ricoh XR. Will be available in combined Pentax-Ricoh mount; accepts 55mm screw-in filters; f/4.5 to f/32; detents at half stops from f/5.6 to f/22; push-pull zoom action; min. foc. dist. 4ft. in normal range, to 1:4 (at 210mm only) in macro range; 100 degree counterclockwise turn from close focus to infinity; 5<sup>7</sup>/<sub>8</sub> in. long, 2<sup>3</sup>/<sub>8</sub> in. diam. (143x60mm) 1 lb. 33<sup>3</sup>/<sub>8</sub> oz. (564g); \$199.

**Practical comments:** Medium-sized and moderately light for a zoom of this focal length; comfortable on average-to-large SLRs; nicely finished in matte black with oversized (2<sup>1</sup>/<sub>2</sub> in wide) focus-zoom ring having rubber studded covering.

"One-touch" focus-zooming action is smooth, if somewhat stiff, but all settings held solidly with no slippage. Macro range is engaged by continuous focus from normal focus settings in 210mm position and 1:4 magnification is attained at 3<sup>1</sup>/<sub>2</sub> ft. from subject. Zoom calibrated at 70, 85, 100, 130 and 210mm; apertures, focal lengths and distance in meters legibly marked in white; footage scale in green.

**Field test slides:** Slides showed crispness at all apertures and focal lengths with good detail to corners. Some lateral color barely detectable in corners at medium focal lengths. Slight barrel distortion noticed at 70mm. Flare was well-controlled throughout, but could affect contrast when shooting wide open into bright light sources. Above average performance for zoom of this focal length range.

**Optical bench analysis** (for optical experts only): On axis at 70mm, slight undercorrect-

### PERFORMANCE

| Our Standard                                                                                                     | as Tested                         |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Focal length: ±5%</b><br>( 66.50- 73.50mm)<br>(199.50-220.50mm)                                               | 73.20<br>204.51mm                 |
| <b>Aperture: ±5%</b><br>(f/4.28-4.73)<br>at 210mm: (f/-4.28-4.73)                                                | f/4.72<br>f/4.68                  |
| <b>Distortion:</b><br>70mm: (±2%)<br>210mm: (±3.5%)                                                              | 1.93% (barrel)<br>1.66% (pinchsn) |
| <b>Light falloff: at f/5.6</b><br>+ 1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.0 stops) | 1.0 stops<br>1.0 stops            |

### RESOLUTION

| SOLIGOR 70-210mm f/4.5<br>at 70mm<br>at 1:49 |                      |    |                      |    |
|----------------------------------------------|----------------------|----|----------------------|----|
| f/                                           | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                          | Excellent            | 55 | Excellent            | 49 |
| 5.6                                          | Excellent            | 62 | Excellent            | 55 |
| 8                                            | V. Good              | 62 | Excellent            | 55 |
| 11                                           | Excellent            | 69 | Excellent            | 55 |
| 16                                           | Excellent            | 62 | Excellent            | 55 |
| 22                                           | V. Good              | 55 | Excellent            | 49 |
| 32                                           | Excellent            | 49 | Excellent            | 44 |

### CONTRAST

| SOLIGOR 70-210mm f/4.5<br>at 70mm<br>at 30 lines/mm |            |    |            |    |
|-----------------------------------------------------|------------|----|------------|----|
| f/                                                  | Center (%) |    | Corner (%) |    |
| 4.5                                                 | High       | 64 | High       | 32 |
| 5.6                                                 | High       | 69 | High       | 36 |
| 8                                                   | High       | 71 | High       | 45 |
| 11                                                  | High       | 67 | High       | 49 |
| 16                                                  | High       | 61 | High       | 42 |
| 22                                                  | High       | 47 | High       | 37 |
| 32                                                  | High       | 35 | Medium     | 29 |

### RESOLUTION

| SOLIGOR 70-210mm f/4.5<br>at 100mm<br>at 1:49 |                      |    |                      |    |
|-----------------------------------------------|----------------------|----|----------------------|----|
| f/                                            | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                           | V. Good              | 49 | Excellent            | 44 |
| 5.6                                           | V. Good              | 55 | Excellent            | 49 |
| 8                                             | V. Good              | 62 | Excellent            | 55 |
| 11                                            | Excellent            | 62 | Excellent            | 55 |
| 16                                            | Excellent            | 62 | Excellent            | 55 |
| 22                                            | V. Good              | 55 | Excellent            | 49 |
| 32                                            | Excellent            | 49 | Excellent            | 44 |

### CONTRAST

| SOLIGOR 70-210mm f/4.5<br>at 100mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 4.5                                                  | High       | 62 | High       | 32 |
| 5.6                                                  | High       | 66 | High       | 35 |
| 8                                                    | High       | 70 | High       | 44 |
| 11                                                   | High       | 62 | High       | 47 |
| 16                                                   | High       | 58 | High       | 40 |
| 22                                                   | High       | 45 | High       | 36 |
| 32                                                   | High       | 34 | Medium     | 28 |

### RESOLUTION

| SOLIGOR 70-210mm f/4.5<br>at 210mm<br>at 1:49 |                      |    |                      |    |
|-----------------------------------------------|----------------------|----|----------------------|----|
| f/                                            | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                           | Excellent            | 49 | Excellent            | 44 |
| 5.6                                           | Excellent            | 55 | Excellent            | 49 |
| 8                                             | Excellent            | 62 | Excellent            | 55 |
| 11                                            | Excellent            | 62 | Excellent            | 55 |
| 16                                            | Excellent            | 55 | Excellent            | 49 |
| 22                                            | Excellent            | 49 | Excellent            | 44 |
| 32                                            | Excellent            | 44 | Excellent            | 39 |

### CONTRAST

| SOLIGOR 70-210mm f/4.5<br>at 210mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 4.5                                                  | High       | 61 | High       | 31 |
| 5.6                                                  | High       | 64 | High       | 34 |
| 8                                                    | High       | 66 | High       | 41 |
| 11                                                   | High       | 59 | High       | 43 |
| 16                                                   | High       | 55 | High       | 40 |
| 22                                                   | High       | 42 | Medium     | 35 |
| 32                                                   | Medium     | 32 | Medium     | 28 |

## Interchangeable Lenses

### MACRO RESOLUTION

| SOLIGOR 70-210mm f/4.5<br>at 210mm<br>at 1:4 |                      |    |                      |    |
|----------------------------------------------|----------------------|----|----------------------|----|
| f/                                           | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                          | Good                 | 32 | V. Good              | 28 |
| 5.6                                          | V. Good              | 36 | Excellent            | 32 |
| 8                                            | Good                 | 40 | Good                 | 32 |
| 11                                           | V. Good              | 40 | V. Good              | 36 |
| 16                                           | Good                 | 36 | V. Good              | 36 |
| 22                                           | Good                 | 36 | Good                 | 32 |
| 32                                           | V. Good              | 36 | V. Good              | 32 |

ed spherical aberration mixed with very slight yellow flare, both gone by f/5.6. Diffraction limited by f/8. Off axis at 70mm, slight skew-ray flare mixed with very slight astigmatism. lateral color throughout.

At 100mm, on axis, slight under-corrected spherical aberration mixed with very slight yellow flare; pattern diffraction limited by f/11. Off axis at 100mm, slight skew-ray flare mixed with slight astigmatism. Lateral color throughout.

At 210mm on axis, slight under-corrected spherical aberration mixed with very slight yellow flare, both gone by f/8. Diffraction-limited by f/11. Off axis at 210mm, slight astigmatism. Lateral color throughout. (October 1985)

## 80-200mm f/4.5 SOLIGOR ZOOM

**Specifications:** 80-200mm f/4.5 Soligor zoom, No. 184160590; in mounts for Canon, Nikon AIS, Minolta MD, Pentax, KA universal thread, Konica, Olympus, Fujica AX, Ricoh XRP, Yashica/Contax, accepts 55mm f/4.5-32; detents at half-stop intervals except below f/5.6 and beyond f/22; min. foc. dist.: 3 ft., 6 in., (1.1m), 1:4X at 200mm setting; 5<sup>3</sup>/<sub>4</sub> in. long, 2<sup>1</sup>/<sub>2</sub>-in. diam. (146 x 63.5mm), 1 lb. 4<sup>1</sup>/<sub>2</sub> oz. (582g); \$165.

**Practical comments:** Single-touch (combined zoom and focusing collar) continuously focusing to macro at 200mm; smooth zooming/focusing action without collar creep; substantial 2<sup>1</sup>/<sub>2</sub>-in. wide diamond-studded rubberized collar moves faultlessly from infinity to minimum focus distance in 90 degree clockwise turn; large, legible white-on-black numerals (green footage scale markings); shiny black finish.

**Field test slides:** Slides were generally crisp and snappy. At 80mm image sharpness improved with corners equal to center by f/8. Very slight barrel distortion noted. At 135mm and 200mm, sharpness again even across field by f/8. Some light falloff noted, gone by one stop down. Flare well-controlled throughout. An average lens overall for this type.

### PERFORMANCE

| Our Standard                                                                                                     | as Tested                         |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Focal length: ±5%</b><br>( 76.00- 84.00mm)<br>(190.00-210.00mm)                                               | 76.25mm<br>197.34mm               |
| <b>Aperture: ±5%</b><br>(f/4.28-4.73)<br>at 200mm: (f/4.28-4.73)                                                 | f/4.33<br>f/4.65                  |
| <b>Distortion:</b><br>80mm: (±2%)<br>200mm: (±2.5%)                                                              | 1.11% (barrel)<br>0.92% (pinchsn) |
| <b>Light falloff: at f/5.6</b><br>+ 1 stop from theoretical limit<br>80mm: (0-1.2 stops)<br>200mm: (0-1.0 stops) | 0.9 stops<br>1.0 stops            |



## Interchangeable Lenses

### RESOLUTION

| SOLIGOR 80-200mm f/4.5<br>at 80mm/1:49 |                      |    |                      |    |
|----------------------------------------|----------------------|----|----------------------|----|
| f/                                     | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                    | V. Good              | 49 | Excellent            | 44 |
| 5.6                                    | V. Good              | 55 | Excellent            | 49 |
| 8                                      | V. Good              | 62 | Excellent            | 55 |
| 11                                     | Excellent            | 62 | Excellent            | 55 |
| 16                                     | Excellent            | 62 | Excellent            | 55 |
| 22                                     | V. Good              | 55 | Excellent            | 49 |
| 32                                     | Excellent            | 49 | Excellent            | 44 |

### CONTRAST

| SOLIGOR 80-200mm f/4.5<br>at 80mm<br>at 30 lines/mm |            |    |            |    |
|-----------------------------------------------------|------------|----|------------|----|
| f/                                                  | Center (%) |    | Corner (%) |    |
| 4.5                                                 | High       | 53 | Medium     | 29 |
| 5.6                                                 | High       | 60 | High       | 46 |
| 8                                                   | High       | 64 | High       | 53 |
| 11                                                  | High       | 65 | High       | 58 |
| 16                                                  | High       | 60 | High       | 51 |
| 22                                                  | High       | 55 | High       | 48 |
| 32                                                  | High       | 38 | High       | 34 |

### RESOLUTION

| SOLIGOR 80-200mm f/4.5<br>at 135mm/1:49 |                      |    |                      |    |
|-----------------------------------------|----------------------|----|----------------------|----|
| f/                                      | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                     | V. Good              | 49 | Excellent            | 44 |
| 5.6                                     | V. Good              | 55 | Excellent            | 49 |
| 8                                       | Good                 | 55 | Excellent            | 49 |
| 11                                      | Excellent            | 62 | Excellent            | 55 |
| 16                                      | Excellent            | 62 | Excellent            | 55 |
| 22                                      | V. Good              | 55 | Excellent            | 49 |
| 32                                      | Excellent            | 49 | Excellent            | 44 |

### CONTRAST

| SOLIGOR 80-200mm f/4.5<br>at 135mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 4.5                                                  | High       | 54 | Medium     | 30 |
| 5.6                                                  | High       | 56 | High       | 45 |
| 8                                                    | High       | 63 | High       | 52 |
| 11                                                   | High       | 65 | High       | 55 |
| 16                                                   | High       | 60 | High       | 50 |
| 22                                                   | High       | 54 | High       | 45 |
| 32                                                   | High       | 39 | High       | 32 |

### RESOLUTION

| SOLIGOR 80-200mm f/4.5<br>at 200mm/1:50 |                      |    |                      |    |
|-----------------------------------------|----------------------|----|----------------------|----|
| f/                                      | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                     | Excellent            | 50 | Excellent            | 45 |
| 5.6                                     | Excellent            | 56 | Excellent            | 50 |
| 8                                       | Excellent            | 56 | Excellent            | 50 |
| 11                                      | Excellent            | 63 | Excellent            | 50 |
| 16                                      | Excellent            | 56 | Excellent            | 50 |
| 22                                      | Excellent            | 50 | Excellent            | 45 |
| 32                                      | Excellent            | 50 | Excellent            | 45 |

### CONTRAST

| SOLIGOR 80-200mm f/4.5<br>at 200mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 4.5                                                  | High       | 52 | Medium     | 28 |
| 5.6                                                  | High       | 57 | High       | 44 |
| 8                                                    | High       | 62 | High       | 50 |
| 11                                                   | High       | 64 | High       | 51 |
| 16                                                   | High       | 58 | High       | 48 |
| 22                                                   | High       | 51 | High       | 39 |
| 32                                                   | High       | 36 | Medium     | 29 |

### MACRO RESOLUTION

| SOLIGOR 80-200mm f/4.5<br>at 200mm/1:4 |                      |    |                      |    |
|----------------------------------------|----------------------|----|----------------------|----|
| f/                                     | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                    | V. Good              | 37 | V. Good              | 29 |
| 5.6                                    | Excellent            | 42 | Excellent            | 33 |
| 8                                      | Good                 | 42 | Good                 | 33 |
| 11                                     | Excellent            | 47 | V. Good              | 37 |
| 16                                     | V. Good              | 42 | V. Good              | 37 |
| 22                                     | Good                 | 37 | Good                 | 33 |
| 32                                     | Good                 | 33 | Good                 | 29 |

**Optical bench analysis** (for optical experts): At 80mm, on axis, very slight undercorrected spherical aberration, with very slight yellow flare gone by two stops down. Diffraction limited by f/11. Off axis, very slight coma, mixed with slight skew-ray flare. Lateral color present.

At 135mm, on axis, very slight undercorrected spherical aberration, and very slight axial astigmatism. Diffraction limited by f/11. Off axis, very slight skew-ray flare, mixed with slight astigmatism. Minimal lateral color. (June 1986)

## TAMRON'S 180mm HAS INTERNAL FOCUS

**Specifications:** SP 180mm f/2.5 Tamron LD IF. No. 500828; in Tamron Adaptall-2 interchangeable mounts for Canon, Fujica ST and AX, Konica, Mamiya ZE, Minolta, Nikon, Leica R4, Olympus, Pentax Universal Thread, Pentax K and ES, Praktica B and LLC, Ricoh, Rollei, Topcon, Yashica/Contax; accepts 77mm filters, f/2.5 (2.8) to f/32; detents at 1/2 stop intervals; 16 elements in 7 groups, min. foc. dist. 4 ft (1.2m); 4 7/8 in. long, 3 1/4 in. diam. (124x83mm); 1 lb. 14 7/8 oz. (876g); \$1111. with reversible bayonet lens hood, and case. Adaptall-2 mounts, \$38 additional except Leica mount (\$76 additional).

**Practical comments:** Compact and lightweight for its speed and focal length, it's the first internal focusing, low dispersion glass 180 from an independent maker we've tested; provides excellent image quality with virtually no color fringing. (Note: This glass is slightly softer than other optical glass, so use a haze filter and clean with care only when necessary.) Very smooth focus from infinity to 4 ft. in 90 degree clockwise-turn of the 1 3/4-in. rubber-studded focusing ring. Stops down to f/32 in a 22 degree clockwise turn of the straight knurled aperture ring at rear. Legible white filled engraved numbers on aperture and metric distance scales. Footage scale is in light green. Depth-of-field scale for f/32 and f/16 only; infrared focusing index in red.

**Field test slides:** Crisp with well-rendered detail in general. Wide open, the images

### RESOLUTION

| TAMRON SP 180mm f/2.5 LD<br>at 1:51 |                      |    |                      |    |
|-------------------------------------|----------------------|----|----------------------|----|
| f/                                  | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 2.5                                 | Excellent            | 51 | Excellent            | 45 |
| 4                                   | Excellent            | 57 | Excellent            | 51 |
| 5.6                                 | Excellent            | 64 | Excellent            | 57 |
| 8                                   | Excellent            | 64 | Excellent            | 57 |
| 11                                  | Excellent            | 57 | Excellent            | 51 |
| 16                                  | Excellent            | 57 | Excellent            | 51 |
| 22                                  | Excellent            | 51 | Excellent            | 45 |
| 32                                  | Excellent            | 51 | Excellent            | 45 |

### CONTRAST

| TAMRON SP 180mm f/2.5 LD<br>at 180mm<br>at 30 lines/mm |            |    |            |    |
|--------------------------------------------------------|------------|----|------------|----|
| f/                                                     | Center (%) |    | Corner (%) |    |
| 2.5                                                    | High       | 43 | High       | 38 |
| 4                                                      | High       | 50 | High       | 40 |
| 5.6                                                    | High       | 65 | High       | 53 |
| 8                                                      | High       | 66 | High       | 55 |
| 11                                                     | High       | 61 | High       | 55 |
| 16                                                     | High       | 52 | High       | 49 |
| 22                                                     | High       | 48 | High       | 39 |
| 32                                                     | High       | 46 | High       | 35 |

were slightly soft in corners, but corners equalled central sharpness by f/5.6. Pin-cushion distortion was noticeable. Flare was well-controlled throughout. Above-average performance for a very fast 180mm lens.

**Optical bench tests** (for optical experts): On axis, very slight under-corrected spherical aberration. Very slight axial color gone by f/8. Diffraction limited by f/11. Off-axis, very slight high order coma was mixed with equally slight astigmatism. Lateral color was minimal. (June 1986)

## TAMRON'S NEW 35-135mm AF LENS

**Specifications:** 35-135mm f/3.5-4.5 Tamron-F AF macro, No. 700855 in Minolta A mount, accepts 55mm accessories; f/3.5 to f/22; min. foc. dist.: 4.75 feet (1.5m), 1.25 feet (.4m) macro; macro magnification ratio 1:4; 15 elements in 13 groups; 4x2.8 inches (102.5x70.5mm) 1 pound 5 5/8 ounces. (613g). \$199.

**Comments:** Smooth black finish with non-integral black ribbed rubber grip. Zooming is done by rotating barrel. Some hesitation and tendency to "hunt" noted in autofocus mode. Serrated manual focus ring is located at front of lens. Manual focusing action is slightly damped and operates smoothly and positively. Distance scale marked in feet and meters behind window in center of lens barrel. Lock in macro setting by pressing small black button at base of lens. Button must be depressed once more to exit macro field. No depth-of-field scale or aperture ring.

**Field test slides:** Slides were crisp and snappy, contrast good with details well rendered. At 35mm, corners were soft at widest setting, improved one stop down. Corners equalled center sharpness by f/8. Barrel distortion noted. Light falloff at widest aperture gone by f/4.5. At 135mm, slight pincushion distortion noted. Flare well controlled throughout. Overall an average lens for this type.

**Optical bench analysis:** At 35mm, on-

### PERFORMANCE

| Our Standard                                                                      | as Tested       |
|-----------------------------------------------------------------------------------|-----------------|
| <b>Focal length:</b> ±5%<br>(171.00-189.00mm)                                     | 177.21mm        |
| <b>Aperture:</b> ±5%<br>(f/2.38-2.63)                                             | f/2.56          |
| <b>Distortion:</b><br>(±2.5%)                                                     | 0.93% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.0 stops) | 0.4 stops       |



## PERFORMANCE

| Our Standard                                                                                                    | As Tested                       |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>Focal length: <math>\pm 5\%</math></b><br>(33.25–36.75mm)<br>(128.25–141.75mm)                               | 33.83mm<br>130.70mm             |
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/3.33–3.68)<br>at 135mm: (f/4.28–4.73)                               | f/3.36<br>f/4.65                |
| <b>Distortion:</b><br>35mm: ( $\pm 2.5\%$ )<br>135mm: ( $\pm 2.5\%$ )                                           | 7% (barrel)<br>1.38% (pincushn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0–1.9 stops)<br>135mm: (0–1.1 stops) | –3 stops<br>–4 stops            |

## RESOLUTION

| TAMRON-F AF 35-135mm f/3.5–4.5<br>at 35mm/1:50 |               |               |           |    |
|------------------------------------------------|---------------|---------------|-----------|----|
| f/                                             | Center (l/mm) | Corner (l/mm) |           |    |
| 3.5                                            | Excellent     | 50            | Excellent | 45 |
| 4.5                                            | Excellent     | 56            | Excellent | 50 |
| 5.6                                            | Excellent     | 63            | Excellent | 50 |
| 8                                              | Excellent     | 63            | Excellent | 56 |
| 11                                             | Excellent     | 56            | Excellent | 50 |
| 16                                             | Excellent     | 50            | Excellent | 45 |
| 22                                             | V. Good       | 45            | Excellent | 40 |

### at 80mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |           |    |
|-----|---------------|---------------|-----------|----|
| 4   | Excellent     | 50            | Excellent | 45 |
| 5.6 | Excellent     | 56            | Excellent | 50 |
| 8   | Excellent     | 63            | Excellent | 56 |
| 11  | Excellent     | 56            | Excellent | 50 |
| 16  | V. Good       | 50            | Excellent | 45 |
| 22  | Good          | 45            | Excellent | 40 |

### at 135mm/1:49

| f/  | Center (l/mm) | Corner (l/mm) |           |    |
|-----|---------------|---------------|-----------|----|
| 4.5 | V. Good       | 49            | Excellent | 44 |
| 5.6 | V. Good       | 55            | Excellent | 49 |
| 8   | V. Good       | 62            | Excellent | 55 |
| 11  | V. Good       | 55            | Excellent | 49 |
| 16  | Good          | 49            | Excellent | 44 |
| 22  | Accept        | 44            | V. Good   | 39 |

## CONTRAST

| at 35mm/30 lines/mm |            |            |        |    |
|---------------------|------------|------------|--------|----|
| f/                  | Center (%) | Corner (%) |        |    |
| 3.5                 | High       | 47         | High   | 37 |
| 4.5                 | High       | 48         | High   | 36 |
| 5.6                 | High       | 55         | Medium | 36 |
| 8                   | High       | 53         | Medium | 32 |
| 11                  | High       | 47         | High   | 41 |
| 16                  | High       | 44         | Medium | 35 |
| 22                  | Medium     | 41         | Medium | 30 |

### at 80mm/30 lines/mm

| f/  | Center (%) | Corner (%) |        |    |
|-----|------------|------------|--------|----|
| 4   | High       | 44         | High   | 33 |
| 5.6 | High       | 52         | High   | 35 |
| 8   | High       | 61         | High   | 42 |
| 11  | High       | 54         | High   | 40 |
| 16  | High       | 50         | High   | 39 |
| 22  | Medium     | 39         | Medium | 35 |

### at 135mm/30 lines/mm

| f/  | Center (%) | Corner (%) |        |    |
|-----|------------|------------|--------|----|
| 4.5 | Medium     | 37         | Medium | 30 |
| 5.6 | Medium     | 38         | High   | 32 |
| 8   | Low        | 39         | Medium | 35 |
| 11  | High       | 40         | Medium | 35 |
| 16  | Low        | 33         | Medium | 30 |
| 22  | V. Low     | 29         | Low    | 25 |

axis, very slight overcorrected spherical aberration. Diffraction limited by f/16. Off-axis, very slight astigmatism mixed with very slight skew-ray flare almost gone by f/16. Lateral color present.

At 80mm, on-axis, very slight overcorrected spherical aberration with very slight red flare gone by two stops.

Diffraction limited by f/16. Off-axis, very slight astigmatism mixed with slight coma almost gone by f/16. Lateral color present.

At 135mm, on-axis, very slight overcorrected spherical aberration with slight flare almost gone by f/8. Diffraction limited by f/16. Lateral color present.

## TAMRON 35-135mm COMPACT ONE-TOUCH

**Specifications:** 35-135mm f/3.5-4.5 Tamron, No. 60182, interchangeable Adaptall-2 mounts for Canon, Fuji AX, Konica, Mamiya ZE, Minolta, Nikon, Olympus, Pentax ES, K, M42 thread, Rollei SL, Topcon RE, Yashica-Contax; accepts 58mm filters; f/3.5 (4.5) to f/32; click stops at half-stop intervals, except from f/16 to f/32; min. foc. dist.: 5 ft. (1.5m), to 1:4 in macro; 3 $\frac{3}{4}$ -in. long, 2 $\frac{5}{16}$ -in. diam. (95 x 59mm); 1 lb. 4 $\frac{1}{2}$  oz. (583g); \$300.

**Practical comments:** Small and light for its long 4:1 zooming range, due in part to its moderate f/3.5-4.5 aperture. Wide, 2-in. textured rubber studded zoom/focus ring takes the lens down to its minimum normal focus range smoothly in a 90° turn. Pushing same ring forward 1 in. zooms from 35mm to 135mm setting. Separate locking control permits turning barrel to go into macro range. Marked macro settings in orange-on-black from 1:7 to 1:4. White-on-black metric distance and aperture scales are clear and legible; green-on-black footage scale is harder to read in dim light. Fine satin-black finish; smooth, swift focus and zoom action;

## PERFORMANCE

| Our Standard                                                                                                    | as Tested                        |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Focal length: <math>\pm 5\%</math></b><br>( 33.25– 36.75mm)<br>(128.25–141.75mm)                             | 36.60mm<br>135.58mm              |
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/3.33–3.68)<br>at 135mm: (f/4.28–4.73)                               | f/3.64<br>f/4.68                 |
| <b>Distortion:</b><br>35mm: ( $\pm 2.5\%$ )<br>135mm: ( $\pm 2.5\%$ )                                           | 0.43 (barrel)<br>0.88 (pincushn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0–1.9 stops)<br>135mm: (0–1.1 stops) | 1.0 stops<br>0.7 stops           |

## RESOLUTION

| TAMRON 35-135mm f/3.5–4.5<br>at 35mm/1:50 |                   |                   |           |    |
|-------------------------------------------|-------------------|-------------------|-----------|----|
| f/                                        | Center (Lines/mm) | Corner (Lines/mm) |           |    |
| 3.5                                       | Excellent         | 50                | Excellent | 45 |
| 5.6                                       | Excellent         | 56                | Excellent | 50 |
| 8                                         | Excellent         | 63                | Excellent | 56 |
| 11                                        | Excellent         | 63                | Excellent | 56 |
| 16                                        | Excellent         | 56                | Excellent | 50 |
| 22                                        | Excellent         | 56                | Excellent | 50 |
| 32                                        | Excellent         | 50                | Excellent | 45 |

## CONTRAST

| TAMRON 35-135mm f/3.5–4.5<br>at 35mm<br>at 30 lines/mm |            |            |        |    |
|--------------------------------------------------------|------------|------------|--------|----|
| f/                                                     | Center (%) | Corner (%) |        |    |
| 3.5                                                    | High       | 45         | High   | 33 |
| 5.6                                                    | High       | 55         | High   | 41 |
| 8                                                      | High       | 66         | High   | 54 |
| 11                                                     | High       | 67         | High   | 50 |
| 16                                                     | High       | 56         | High   | 44 |
| 22                                                     | High       | 46         | Medium | 37 |
| 32                                                     | Medium     | 34         | Medium | 38 |

## Interchangeable Lenses

### RESOLUTION

| TAMRON 35-135mm f/3.5–4.5<br>at 80mm/1:50 |                   |                   |           |    |
|-------------------------------------------|-------------------|-------------------|-----------|----|
| f/                                        | Center (Lines/mm) | Corner (Lines/mm) |           |    |
| 4.3                                       | Excellent         | 50                | Excellent | 45 |
| 5.6                                       | Excellent         | 56                | Excellent | 50 |
| 8                                         | Excellent         | 56                | Excellent | 50 |
| 11                                        | Excellent         | 63                | Excellent | 56 |
| 16                                        | Excellent         | 63                | Excellent | 56 |
| 22                                        | Excellent         | 56                | Excellent | 50 |
| 32                                        | Excellent         | 50                | Excellent | 45 |

### CONTRAST

| TAMRON 35-135mm f/3.5–4.5<br>at 80mm<br>at 30 lines/mm |            |            |        |    |
|--------------------------------------------------------|------------|------------|--------|----|
| f/                                                     | Center (%) | Corner (%) |        |    |
| 4.3                                                    | High       | 47         | High   | 34 |
| 5.6                                                    | High       | 57         | High   | 44 |
| 8                                                      | High       | 68         | High   | 54 |
| 11                                                     | High       | 64         | High   | 51 |
| 16                                                     | High       | 54         | High   | 42 |
| 22                                                     | High       | 46         | High   | 38 |
| 32                                                     | High       | 35         | Medium | 29 |

### RESOLUTION

| TAMRON 35-135mm f/3.5–4.5<br>at 135mm/1:50 |                   |                   |           |    |
|--------------------------------------------|-------------------|-------------------|-----------|----|
| f/                                         | Center (Lines/mm) | Corner (Lines/mm) |           |    |
| 4.5                                        | Excellent         | 56                | Excellent | 50 |
| 5.6                                        | Excellent         | 56                | Excellent | 50 |
| 8                                          | Excellent         | 63                | Excellent | 56 |
| 11                                         | Excellent         | 63                | Excellent | 56 |
| 16                                         | Excellent         | 56                | Excellent | 50 |
| 22                                         | Excellent         | 56                | Excellent | 50 |
| 32                                         | Excellent         | 50                | Excellent | 45 |

### CONTRAST

| TAMRON 35-135mm f/3.5–4.5<br>at 135mm<br>at 30 lines/mm |            |            |        |    |
|---------------------------------------------------------|------------|------------|--------|----|
| f/                                                      | Center (%) | Corner (%) |        |    |
| 4.5                                                     | High       | 46         | High   | 33 |
| 5.6                                                     | High       | 56         | High   | 42 |
| 8                                                       | High       | 69         | High   | 55 |
| 11                                                      | High       | 63         | High   | 52 |
| 16                                                      | High       | 54         | High   | 44 |
| 22                                                      | High       | 46         | High   | 36 |
| 32                                                      | High       | 34         | Medium | 28 |

### MACRO RESOLUTION

| NIKOR AF 35-70 mm f/3.3–4.5<br>at 35mm/1:50 |                   |                   |           |    |
|---------------------------------------------|-------------------|-------------------|-----------|----|
| f/                                          | Center (Lines/mm) | Corner (Lines/mm) |           |    |
| 3.5                                         | Accept            | 32                | V. Good   | 29 |
| 5.6                                         | Accept            | 36                | V. Good   | 29 |
| 8                                           | Accept            | 36                | Good      | 29 |
| 11                                          | Good              | 40                | V. Good   | 32 |
| 16                                          | Good              | 40                | V. Good   | 32 |
| 22                                          | V. Good           | 45                | Excellent | 36 |
| 32                                          | V. Good           | 40                | Excellent | 32 |

zoom settings slip somewhat when lens is held vertically.

**Field test slides:** Test transparencies crisp and snappy with well-rendered detail. At 35mm, corner detail is slightly soft at maximum aperture, but equal to center sharpness by one f/stop down. Some light falloff noticeable wide open gone one stop down. Similar pattern at 80mm and 135mm settings: corner sharpness equal to center sharpness by one f/stop down. Slight barrel distortion noted at 35mm, slight pincushion distortion at 135mm. Flare well controlled throughout. Macro quality acceptable from



## Interchangeable Lenses

three f/stops down. Overall, an above average lens for its zoom range.

**Optical bench analysis** (for optical experts only): At 35mm, on axis, very slight red flare present, gone by f/8. Very slight overcorrected spherical aberration. Diffraction limited pattern by f/11. Off axis, slight skew-ray flare mixed with slight coma. Slight lateral color noted.

At 80mm, on axis, very slight red flare visible, gone by f/8. Very slight overcorrected spherical aberration. Diffraction limited pattern by f/11. Off axis, slight skew-ray flare mixed with slight astigmatism. Lateral color noted.

At 135mm, on axis, slight axial color mixed with slight overcorrected spherical aberration. Diffraction limited pattern by f/16. Off axis, slight skew-ray flare mixed with slight astigmatism. Lateral color present. (June 1986)

### TAMRON 35-210mm MACRO ZOOM

**Specifications:** 35-210mm f/3.5-4.2 Tamron SP Zoom; No. 407211; interchangeable Adaptall-2 mounts for Nikon, Canon, Minolta, Fuji AX, Fuji ST, Mamiya ZE, Rollei SL, Topcon RE, Pentax ES, K, M-42 thread, Olympus, Konica, Yashica/Contax; accepts 67mm screw-in filters; f/3.5 (4.2) to f/22 plus AE setting; detents at half stops to f/22; push-pull zoom action; marked for 35, 50, 80, 135, and 210mm; color-coded apertures match depth-of-field scale on barrel; infrared focus index; min. foc. dist.: 5 ft. in normal range, to 1:3.8X (at 35mm setting only) in macro range; 150° clockwise turn from normal range close focus to infinity; 4 7/8 in. long, 2 15/16 in. diam. (125.5x73mm) 30 15/16 oz. (875g); \$473.00 with case and shade (adapters \$38 ea.)

**Practical comments:** About the size and weight of a 200mm f/3.5, this lens balances nicely on average-to-large sized SLRs, is very well finished in traditional Tamron glossy black enamel, and has large, legible white-on-black aperture and metric distance scales with footages in pale green. Minimum and maximum focal lengths are in orange and blue respectively, matching dual aperture indices on barrel, with remaining focal lengths in white. On either side of white focus index line are color-coded depth-of-field lines matching color bars under f/8, 16, and 22 apertures. However, these are neither convenient nor legible when shooting at focal lengths below about 50mm.

Both zooming and focusing are controlled by a very wide (slightly over 2 1/2 in.) rubber-

#### PERFORMANCE

| Our Standard                                                                                                    | as Tested                             |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <b>Focal length:</b> ±5%<br>(33.25-36.75mm)<br>(199.50-220.50mm)                                                | 36.14mm<br>205.58mm                   |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 210mm: (f/3.99-4.41)                                                | f/3.41<br>f/4.31                      |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>210mm: (±3.5%)                                                           | under 1% (barrel)<br>2.06% (pincushn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>210mm: (0-1.0 stops) | 1.5 stops<br>0.7 stops                |

#### RESOLUTION

| TAMRON 35-210mm f/3.5-4.2<br>at 35mm<br>at 1:49 |                  |                  |           |    |
|-------------------------------------------------|------------------|------------------|-----------|----|
| f/                                              | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 3.5                                             | V. Good          | 49               | Excellent | 44 |
| 5.6                                             | V. Good          | 49               | Excellent | 44 |
| 8                                               | V. Good          | 55               | Excellent | 49 |
| 11                                              | Excellent        | 55               | Excellent | 49 |
| 16                                              | Excellent        | 55               | Excellent | 49 |
| 22                                              | V. Good          | 49               | Excellent | 44 |

#### CONTRAST

| TAMRON 35-210mm f/3.5-4.2<br>at 35mm<br>at 30 lines/mm |               |               |        |    |
|--------------------------------------------------------|---------------|---------------|--------|----|
| f/                                                     | Center<br>(%) | Corner<br>(%) |        |    |
| 3.5                                                    | High          | 44            | High   | 40 |
| 5.6                                                    | High          | 63            | High   | 47 |
| 8                                                      | High          | 66            | High   | 53 |
| 11                                                     | High          | 64            | Medium | 38 |
| 16                                                     | High          | 61            | Medium | 33 |
| 22                                                     | High          | 54            | Low    | 29 |

#### RESOLUTION

| TAMRON 35-210mm f/3.5-4.2<br>at 80mm<br>at 1:49 |                  |                  |           |    |
|-------------------------------------------------|------------------|------------------|-----------|----|
| f/                                              | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 3.9                                             | V. Good          | 49               | Excellent | 44 |
| 5.6                                             | V. Good          | 55               | Excellent | 49 |
| 8                                               | Good             | 55               | Excellent | 49 |
| 11                                              | V. Good          | 55               | Excellent | 49 |
| 16                                              | Good             | 49               | Excellent | 44 |
| 22                                              | Good             | 49               | Excellent | 44 |

#### CONTRAST

| TAMRON 35-210mm f/3.5-4.2<br>at 80mm<br>at 30 lines/mm |               |               |      |    |
|--------------------------------------------------------|---------------|---------------|------|----|
| f/                                                     | Center<br>(%) | Corner<br>(%) |      |    |
| 3.9                                                    | High          | 47            | High | 38 |
| 5.6                                                    | High          | 57            | High | 58 |
| 8                                                      | High          | 60            | High | 59 |
| 11                                                     | High          | 62            | High | 58 |
| 16                                                     | High          | 64            | High | 50 |
| 22                                                     | High          | 44            | High | 41 |

#### RESOLUTION

| TAMRON 35-210mm f/3.5-4.2<br>at 210mm<br>at 1:50 |                  |                  |           |    |
|--------------------------------------------------|------------------|------------------|-----------|----|
| f/                                               | Center<br>(l/mm) | Corner<br>(l/mm) |           |    |
| 4.2                                              | Excellent        | 50               | Excellent | 45 |
| 5.6                                              | Excellent        | 50               | Excellent | 45 |
| 8                                                | Excellent        | 56               | Excellent | 50 |
| 11                                               | Excellent        | 50               | Excellent | 45 |
| 16                                               | Excellent        | 50               | Excellent | 45 |
| 22                                               | Excellent        | 45               | Excellent | 40 |

#### CONTRAST

| TAMRON 35-210mm f/3.5-4.2<br>at 210mm<br>at 30 lines/mm |               |               |      |    |
|---------------------------------------------------------|---------------|---------------|------|----|
| f/                                                      | Center<br>(%) | Corner<br>(%) |      |    |
| 4.2                                                     | High          | 43            | High | 39 |
| 5.6                                                     | High          | 58            | High | 49 |
| 8                                                       | High          | 63            | High | 55 |
| 11                                                      | High          | 64            | High | 57 |
| 16                                                      | High          | 60            | High | 49 |
| 22                                                      | High          | 45            | High | 40 |

#### MACRO RESOLUTION

| Tamron 35-210mm f/3.5-4.2<br>at 35mm<br>at 1:4 |                  |                  |         |    |
|------------------------------------------------|------------------|------------------|---------|----|
| f/                                             | Center<br>(l/mm) | Corner<br>(l/mm) |         |    |
| 3.5                                            | Accept           | 38               | Good    | 27 |
| 5.6                                            | Excellent        | 60               | V. Good | 30 |
| 8                                              | Excellent        | 60               | Good    | 30 |
| 11                                             | Excellent        | 60               | Good    | 30 |
| 16                                             | Excellent        | 60               | V. Good | 34 |
| 22                                             | Excellent        | 54               | V. Good | 34 |

ized textured collar, judged very convenient. Focusing action is smooth, zooming a bit stiff, but all settings are held without slippage regardless of lens-holding position. To select macro range, zoom lens back to 35mm setting and turn focusing ring clockwise until macro detent is engaged and orange "macro" indications line up, then push-pull barrel over 1/2 in. macro range to focus. System is workable but continuous macro focus by turning barrel is preferable, and macro at longest focal length would be more convenient.

**Field test slides:** In general, slides were crisp and snappy. Some softness at 35mm wide open improved noticeably by f/8 with sharpness maintained at smaller apertures. Corner sharpness equal to center at all apertures and focal lengths but some barrel distortion was observed at 35mm setting. At 80mm, slides were somewhat soft at the widest aperture but improved at f/5.6 on down. At 210mm, sharpness was maintained across the field at all apertures, but some pin-cushion distortion was noticeable. Flare was well controlled throughout, but may affect contrast when shooting wide open under adverse conditions. Overall performance average to above average with macro performance, above average for a lens of this type.

**Optical bench analysis:** (for optical experts only): At 35mm, on axis overcorrected spherical aberration with slight axial color were observed, but pattern was diffraction limited by f/8. Off axis, at 35mm, we noted slight skew-ray flare and slight coma, with lateral color throughout.

At 80mm, on axis, we observed overcorrected spherical aberration with slight yellow flare, but the pattern was diffraction limited by f/8. At 80mm, off axis, we noted slight skew-ray flare mixed with slight astigmatism, and lateral color was present throughout.

At 210mm, on axis, we found secondary chromatic aberration and astigmatism, but both were gone by f/8, at which point the pattern was diffraction limited. At 210mm, off axis we noted skew-ray flare mixed with slight astigmatism, and lateral color throughout. (January 1985)

## TOKINA'S LONG-RANGE TELE-ZOOM

**Specifications:** 100-500mm SD f/5.6 Tokina, No. 8500778 in fixed mounts for Canon, Fujica, AX Konica, Minolta, Nikon, Olympus, Pentax KA and Yashica/Contax SLRs, accepts 35.5mm internal filters, 95mm threaded accessories; f/5.6 to 32 with half-stop detents betw. 8 and 22. Focus and zoom lock, rotating threaded



## PERFORMANCE

| Our Standard                                                                                                     | As Tested                          |
|------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length: ±5%</b><br>(142.50–157.50mm)<br>(475.00–525.00mm)                                               | 154.15mm<br>489.40mm               |
| <b>Aperture: ±5%</b><br>(f/5.32–5.88)<br>at 500mm: (f/5.32–5.88)                                                 | f/5.79<br>f/5.78                   |
| <b>Distortion:</b><br>150mm: (±2.5%)<br>500mm: (±3.5%)                                                           | 1.33% (pincshn)<br>1.49% (pincshn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>150mm: (0–1.1 stops)<br>500mm: (0–1.0 stops) | 0.7 stops<br>0.7 stops             |

## RESOLUTION

**TOKINA 150-500mm f/5.6  
at 150mm/1:50**

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 5.6 | Excellent     | 40            |
| 8   | Excellent     | 40            |
| 11  | Excellent     | 45            |
| 16  | Excellent     | 45            |
| 22  | Excellent     | 40            |
| 32  | Excellent     | 40            |

**at 300mm/1:51**

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 5.6 | Excellent     | 36            |
| 8   | Excellent     | 40            |
| 11  | Excellent     | 45            |
| 16  | Excellent     | 45            |
| 22  | Excellent     | 40            |
| 32  | Excellent     | 36            |

**at 500mm/1:42**

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 5.6 | Good          | 30            |
| 8   | V. Good       | 33            |
| 11  | Good          | 33            |
| 16  | V. Good       | 38            |
| 22  | Good          | 33            |
| 32  | Excellent     | 30            |

## CONTRAST

**at 150mm/30 lines/mm**

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 5.6 | Medium     | 30         |
| 8   | High       | 38         |
| 11  | High       | 40         |
| 16  | High       | 39         |
| 22  | High       | 35         |
| 32  | Medium     | 32         |

**at 300mm/30 lines/mm**

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 5.6 | Medium     | 19         |
| 8   | Medium     | 23         |
| 11  | High       | 30         |
| 16  | High       | 34         |
| 22  | High       | 36         |
| 32  | High       | 33         |

**at 500mm/30 lines/mm**

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 5.6 | V. Low     | 15         |
| 8   | Low        | 17         |
| 11  | V. Low     | 19         |
| 16  | Low        | 21         |
| 22  | Medium     | 29         |
| 32  | Medium     | 31         |

tripod socket, extendable lens shade. Min. foc. dist.: 8 ft. (2.5m); 12 3/8 inches long, 4 1/16 inches diameter (103mm), 4.9 lbs. (2230g). \$2,008 including vinyl case and 35.5mm UV filter. Accessory filter sets, \$49.95 each in color or black-and-white.

**Comments:** Super low dispersion glass, 15 elements in 31 groups, adds up to a high quality long zoom. Compact but relatively heavy single control push/pull zoom with zoom/focus lock, collapsible hood, filter slot for small, inexpensive 35.5mm threaded filters. Heavy to handheld (try a monopod) but a joy on a tripod where its 5-1 range makes for compositional variety even when locked to a stationary tripod. Large, locking, rotating tripod socket would be even better if also threaded for heavy duty 3/8-inch European thread mounting for this five pound, 12-inch pro grade tele-zoom.

Smooth working six-inch wide, heavily knurled zoom/focus collar, pulls back for longer focal lengths for easy operation while small but effective zoom lock restrains inadvertent zooms or focal shifts.

Aperture and metric distance scales in white, footage in yellow; depth of field scales at f/32, 22 and 11, infrared focusing index from 150-250mm only. It's a one-lens tie kit...and, at f/5.6, fast enough for most sports situations with today's fast films.

**Field test slides:** Overall, our test slides were crisp and snappy. At 150mm, wide-open, we saw slight color fringing, with corners soft. Corners equalled central sharpness by f/11. Very slight falloff noted wide open. At 300mm corners equalled center by f/11. At 500mm, color fringing seen in corners wide-open. Corners equalled center by f/16. Flare well-controlled throughout. Overall, an above-average performer for a long range tele-zoom.

**Optical bench analysis:** On axis, at 150mm, the image was sharp with very slight zonal spherical flare. Diffraction limited by f/11. At 300mm, moderately sharp with zonal spherical flare noted. Diffraction limited between f/11-16. At 500mm, image was moderately sharp with prominent zonal flare. Slight green-purple secondary blur. Diffraction limited by f/16.

Off axis, at 150mm, saw slight coma, no astigmatism, slight green-purple lateral. Sharp by f/16. By 500mm, slight coma, very slight astigmatism, slight green-purple lateral color, critically sharp by f/22.

## COMPACT, ONE-TOUCH 35-200mm f/4-5.6 TOKINA

**Specifications:** 35-200mm f/4-5.6 Tokina SD, No. 8501791; in mounts for Canon, Nikon, Minolta MD, Pentax KA, Olympus, Konica, Ricoh, Yashica/Contax M-thread; accepts 62mm filters; f/4 (5.6) to f/22; de-tents at half-stop intervals between f/5.6 and f/16, full stops below f/5.6 and above f/16; min foc dist.: 5 ft., 5 in. in normal range, to 1:4 at 200mm in macro range; 4 1/2 in. long, 2 5/8 in. in diam. (113.2 x 66mm); 21 1/2 oz. (610g); 16 elements in 13 groups; \$309.

## Interchangeable Lenses PERFORMANCE

| Our Standard                                                                                                    | as Tested                         |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Focal length: ±5%</b><br>( 33.25- 36.75mm)<br>(190.00-210.00mm)                                              | 35.99mm<br>192.93mm               |
| <b>Aperture: ±5%</b><br>(f/3.80-4.20)<br>at 200mm: (f/5.32-5.88)                                                | f/3.97<br>f/5.60                  |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>200mm: (±2.5%)                                                           | 0.89% (barrel)<br>0.46% (pincshn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>200mm: (0-1.0 stops) | 0.8 stops<br>0.3 stops            |

## RESOLUTION

**TOKINA 35-200mm f/4-5.6  
at 35mm/1:49**

| f/  | Center (Lines/mm) | Corner (Lines/mm) |
|-----|-------------------|-------------------|
| 4   | V. Good           | 44                |
| 5.6 | Excellent         | 49                |
| 8   | Excellent         | 55                |
| 11  | Excellent         | 55                |
| 16  | Excellent         | 49                |
| 22  | V. Good           | 44                |

## CONTRAST

**TOKINA 35-200mm f/4-5.6  
at 35mm  
at 30 lines/mm**

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4   | High       | 32         |
| 5.6 | High       | 39         |
| 8   | High       | 43         |
| 11  | High       | 51         |
| 16  | High       | 48         |
| 22  | Medium     | 31         |

## RESOLUTION

**TOKINA 35-200mm f/4-5.6  
at 105mm/1:49**

| f/  | Center (Lines/mm) | Corner (Lines/mm) |
|-----|-------------------|-------------------|
| 5.1 | V. Good           | 44                |
| 5.6 | V. Good           | 49                |
| 8   | V. Good           | 55                |
| 11  | Excellent         | 55                |
| 16  | V. Good           | 49                |
| 22  | Good              | 44                |

## CONTRAST

**TOKINA 35-200mm f/4-5.6  
at 105mm  
at 30 lines/mm**

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 5.1 | High       | 34         |
| 5.6 | High       | 41         |
| 8   | High       | 47         |
| 11  | High       | 53         |
| 16  | High       | 41         |
| 22  | High       | 30         |

**Practical comments:** Quite moderate in size and lightweight for a 35-200mm single-touch zoom; nicely finished in satin-black; gets from infinity to min. foc. dist. in smooth 100 degree counter-clockwise turn of very wide (2 3/8 in.) rubberized textured zoom/focus collar, from 35mm to 200mm setting by pushing collar smoothly forward 1 1/2 in.; holds settings well; to select macro, push collar forward to 200mm setting, turn focus ring beyond 1.6m mark to closer distances which are also indicated in blue-on-black magnification scale on right-hand side of barrel; marked focal lengths of 35, 50, 70,



## Interchangeable Lenses

### RESOLUTION

| TOKINA 35-200mm f/4-5.6<br>at 200mm/1:50 |                      |    |                      |    |
|------------------------------------------|----------------------|----|----------------------|----|
| f/                                       | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 5.6                                      | Excellent            | 50 | Excellent            | 45 |
| 8                                        | Excellent            | 56 | Excellent            | 50 |
| 11                                       | Excellent            | 63 | Excellent            | 56 |
| 16                                       | Excellent            | 56 | Excellent            | 50 |
| 22                                       | Excellent            | 50 | Excellent            | 45 |

### CONTRAST

| TOKINA 35-200mm f/4-5.6<br>at 200mm<br>at 30 lines/mm |            |    |            |    |
|-------------------------------------------------------|------------|----|------------|----|
| f/                                                    | Center (%) |    | Corner (%) |    |
| 5.6                                                   | High       | 50 | High       | 41 |
| 8                                                     | High       | 58 | High       | 48 |
| 11                                                    | High       | 62 | High       | 52 |
| 16                                                    | High       | 57 | High       | 46 |
| 22                                                    | V. Good    | 42 | Medium     | 30 |

### MACRO RESOLUTION

| TOKINA 35-200mm f/4-5.6<br>at 200mm/1:4 |                      |    |                      |    |
|-----------------------------------------|----------------------|----|----------------------|----|
| f/                                      | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 5.6                                     | V. Good              | 36 | V. Good              | 29 |
| 8                                       | Excellent            | 40 | Excellent            | 32 |
| 11                                      | Excellent            | 45 | V. Good              | 36 |
| 16                                      | V. Good              | 40 | V. Good              | 36 |
| 22                                      | Good                 | 36 | Good                 | 32 |

105 and 200mm; all numerals reasonably large and legible, but macro scale and middle focal lengths in blue-on-black hard to see in dim light; metric distances in white, footages in yellow on black; comprehensive depth-of-field scale hard to read at focal lengths above 105mm; dual aperture index, color coded to focal length scale; lens balances very well on small, medium-sized and large SLRs; split-image rangefinder remains usable with most late model SLRs, but may suffer partial blackout at longest focal lengths settings with older models. Turning direction of the focusing ring matches that of camera-makers' lenses—a good idea.

**Field test slides:** Transparencies crisp and snappy with fine detail well rendered throughout. At all focal lengths, center sharpness equalled corner sharpness at one stop down from maximum aperture. At 35mm, wide open, some color fringing seen in corner images, gone by f/8; some barrel distortion. At 200mm, pincushion distortion noted. Flare well controlled throughout. Somewhat above average performance for lens type.

**Optical bench analysis** (for optical experts): At 35mm on axis, very slight over-corrected spherical aberration, very slight chromatic aberration, diffraction limited by f/8. Off axis, very slight skew-ray flare mixed with slight astigmatism; some lateral color.

At 105mm, on axis, same as at 35mm setting, but diffraction limited by f/11. Off axis, very slight skew-ray flare mixed with very slight coma, some lateral color.

At 200mm, very slight over-corrected spherical aberration mixed with very slight chromatic aberration, diffraction limited by f/16. Off axis, very slight coma mixed with very slight astigmatism, some lateral color. (June 1986)

## SUPER SMALL 70-210mm f/4-5.6 TOKINA

**Specifications:** 70-210mm f/4-5.6 Tokina SD, No. 8501820; in mounts for Canon, Nikon, Minolta MD, Pentax KA, Olympus, Konica, Ricoh, Yashica/Contax; accepts 52mm filters; f/4 (5.6) to f/32 plus locking "A" (auto-exposure) setting; half-stop detents except between f/4 and f/5.6 and f/22 and f/32; min. fpc. dist.: 3 ft., 7 in. (1.1m) in normal range, to 1:4 in macro range at 210mm; 3<sup>3</sup>/<sub>8</sub>-in. long, 2<sup>9</sup>/<sub>16</sub> in. diam. (85x66mm); 14<sup>1</sup>/<sub>4</sub> oz. (400g); 12 elements in 8 groups; \$269.00

**Practical comments:** Remarkably compact and light single-touch 70-210mm zoom; 1<sup>7</sup>/<sub>8</sub>-in. wide, grippable textured rubberized zoom/focus collar moves from infinity to min. fpc. dist. in smooth clockwise 220 degree turn, zooms from 70-210mm in smooth 1<sup>7</sup>/<sub>8</sub> in. forward push, holds settings well. To select macro, turn collar to min. fpc. dist., push zoom/focus ring forward while noting position of blue macro arrow with respect to blue-on-black magnification scale on barrel (at left of focusing index); aperture and focusing scale numerals legible, with metric distances in white, footages in yellow-on-black; blue macro and middle focal length numerals judged hard to see in dim light; depth-of-field scale comprehensive but tricky to use at focal lengths above 150mm; excellent satin-black finish; central split-image rangefinder useable with most late-

### PERFORMANCE

| Our Standard                                                                                                    |  | as Tested                   |  |
|-----------------------------------------------------------------------------------------------------------------|--|-----------------------------|--|
| <b>Focal length: ±5%</b><br>( 66.50- 73.50mm)<br>(199.50-220.50mm)                                              |  | 72.90mm<br>206.80mm         |  |
| <b>Aperture: ±5%</b><br>(f/3.80-4.20)<br>at 210mm: (f/5.32-5.88)                                                |  | f/4.67<br>f/5.87            |  |
| <b>Distortion:</b><br>70mm: (±2%)<br>210mm: (±3.5%)                                                             |  | under 1%<br>1.4% (pincushn) |  |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>210mm: (0-1.0 stops) |  | 0.8 stops<br>0.5 stops      |  |

### RESOLUTION

| TOKINA 70-210mm f/4-5.6<br>at 70mm/1:49.01 |                      |    |                      |    |
|--------------------------------------------|----------------------|----|----------------------|----|
| f/                                         | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                                          | V. Good              | 49 | Excellent            | 44 |
| 5.6                                        | V. Good              | 55 | Excellent            | 49 |
| 8                                          | V. Good              | 62 | Excellent            | 55 |
| 11                                         | Excellent            | 62 | Excellent            | 55 |
| 16                                         | Excellent            | 62 | Excellent            | 55 |
| 22                                         | V. Good              | 55 | Excellent            | 49 |
| 32                                         | Excellent            | 49 | Excellent            | 44 |

### CONTRAST

| TOKINA 70-210mm f/4-5.6<br>at 70mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 4                                                    | High       | 50 | High       | 40 |
| 5.6                                                  | High       | 55 | High       | 43 |
| 8                                                    | High       | 60 | High       | 50 |
| 11                                                   | High       | 64 | High       | 53 |
| 16                                                   | High       | 58 | High       | 47 |
| 22                                                   | High       | 45 | High       | 40 |
| 32                                                   | High       | 40 | High       | 30 |

### RESOLUTION

| TOKINA 70-210mm f/4-5.6<br>at 150mm/1:49.01 |                      |    |                      |    |
|---------------------------------------------|----------------------|----|----------------------|----|
| f/                                          | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 5                                           | Excellent            | 49 | Excellent            | 44 |
| 5.6                                         | Excellent            | 55 | Excellent            | 49 |
| 8                                           | Excellent            | 62 | Excellent            | 55 |
| 11                                          | Excellent            | 62 | Excellent            | 55 |
| 16                                          | Excellent            | 62 | Excellent            | 55 |
| 22                                          | Excellent            | 55 | Excellent            | 49 |
| 32                                          | Excellent            | 49 | Excellent            | 44 |

### CONTRAST

| TOKINA 70-210mm f/4-5.6<br>at 150mm<br>at 30 lines/mm |            |    |            |    |
|-------------------------------------------------------|------------|----|------------|----|
| f/                                                    | Center (%) |    | Corner (%) |    |
| 5.1                                                   | High       | 56 | High       | 45 |
| 5.6                                                   | High       | 58 | High       | 48 |
| 8                                                     | High       | 61 | High       | 53 |
| 11                                                    | High       | 66 | High       | 55 |
| 16                                                    | High       | 59 | High       | 49 |
| 22                                                    | High       | 46 | High       | 40 |
| 32                                                    | High       | 38 | High       | 30 |

### RESOLUTION

| TOKINA 70-210mm f/4-5.6<br>at 210mm/1:50 |                      |    |                      |    |
|------------------------------------------|----------------------|----|----------------------|----|
| f/                                       | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 5.6                                      | Excellent            | 56 | Excellent            | 50 |
| 8                                        | Excellent            | 63 | Excellent            | 56 |
| 11                                       | Excellent            | 63 | Excellent            | 56 |
| 16                                       | Excellent            | 56 | Excellent            | 50 |
| 22                                       | Excellent            | 50 | Excellent            | 45 |
| 32                                       | Excellent            | 50 | Excellent            | 45 |

### CONTRAST

| TOKINA 70-210mm f/4-5.6<br>at 210mm<br>at 30 lines/mm |            |    |            |    |
|-------------------------------------------------------|------------|----|------------|----|
| f/                                                    | Center (%) |    | Corner (%) |    |
| 5.6                                                   | High       | 56 | High       | 45 |
| 8                                                     | High       | 60 | High       | 49 |
| 11                                                    | High       | 64 | High       | 53 |
| 16                                                    | High       | 58 | High       | 49 |
| 22                                                    | High       | 47 | High       | 39 |
| 32                                                    | High       | 40 | High       | 30 |

### MACRO RESOLUTION

| TOKINA 70-210mm f/4-5.6<br>at 210mm/1:4 |                      |    |                      |    |
|-----------------------------------------|----------------------|----|----------------------|----|
| f/                                      | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 5.6                                     | Excellent            | 40 | Excellent            | 36 |
| 8                                       | Excellent            | 45 | Excellent            | 36 |
| 11                                      | Excellent            | 51 | Excellent            | 40 |
| 16                                      | Excellent            | 45 | Excellent            | 40 |
| 22                                      | V. Good              | 40 | V. Good              | 36 |
| 32                                      | V. Good              | 36 | V. Good              | 32 |

model SLRs, but may cause partial blackout with some older models at focal lengths at or near 210mm setting.

**Field test slides:** Transparencies showed detail well rendered, crisp and snappy images at all apertures and focal lengths. At 70mm, some color fringing in corners wide open, but gone at one stop down, at which point corner and center sharpness were equal. Similar performance at 135 and 210mm, with moderate pincushion distortion noted at latter focal length. Flare well controlled throughout. Overall, above average performance for a tele zoom of this type.



**Optical bench analysis** (for optical experts): On axis, at 70mm, slight overcorrected spherical aberration, slight yellow flare gone by f/8, diffraction limited by f/11. Off axis, very slight skew-ray flare mixed with slight astigmatism, some lateral color.

On axis, at 150mm, pattern similar to that at 70mm but diffraction limited by f/16. Off axis, very slight skew-ray flare and astigmatism, some lateral color.

On axis, at 210mm, slight overcorrected spherical aberration, very slight red flare gone at 2 stops down, diffraction limited by f/16. Off axis, very slight high order coma mixed with very slight astigmatism, some lateral color. (April 1986)

## COMPACT 90mm MACRO FROM TOKINA

**Specifications:** 90mm f/2.5 Tokina AT-X Macro; mounts for Canon, Minolta, Nikon AI, Olympus, Pentax K. Yashica/Contax No. 8402146; accepts 55mm accessories; f/2.5 to f/32; 1/2-stop detents from f/4 to f/22, no detents between f/2.5 and f/4, f/22 and f/32; min. foc. dist. 15 1/4 in. (.39m), 14 in. (.35m) with 1:1 adapter (included); 3 1/4 in. long, 2 1/2 in. diam. (65.5 x 77mm); with 1:1 adapter 5 1/4 in. (133.4mm); 1 lb. 2 1/4 oz. (520g); with 1:1 adapter 1 lb. 9 oz. (710g); \$459.90.

**Practical comments:** A relatively fast, compact medium tele macro, the 90mm f/2.5 Tokina is a handy focal length both for portraits and close-up photography. Compared to a 50mm macro lens, this longer focal length offers the convenience of an increased working distance, thus providing more room to place lighting equipment and reflectors.

Without the included 1:1 adapter, the Tokina focuses down to 1:2. Adding the extender (which includes three lens elements) permits life-size reproduction with no loss of maximum aperture. This facilitates focusing in low light and at high magnifications while maintaining maximum aperture metering and auto exposure features. For those who work extensively in the 1:2 to 1:1 magnification range, the necessity of using an extender may be a disadvantage, but for most of us, the light weight and compact size of a lens focusing from infinity to 1:2 is a boon.

Compact yet easy to handle, the Tokina is well finished and operates smoothly. Focuses from infinity to 1:2 in approx. 280° clockwise turn of 1 1/4 in. wide textured rubber collar; green footage scale, blue and red magnification scales moderately easy to read; white depth of field, aperture and red and blue exposure compensation scales are small but legible; aperture ring 1/8 in. wide ribbed metal; hard padded case holds both lens and 1:1 adapter, included.

**Field test slides:** At infinity, wide open, our

### PERFORMANCE

| Our Standard                                                                      | as Tested          |
|-----------------------------------------------------------------------------------|--------------------|
| <b>Focal length:</b> ±5%<br>(85.50-94.50mm)                                       | 88.30mm            |
| <b>Aperture:</b> ±5%<br>(f/2.38-2.63)                                             | f/2.58             |
| <b>Distortion:</b><br>90mm: (±2%)                                                 | under 1% (pincshn) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>(0-1.2 stops) | 0.34 stops         |

### RESOLUTION

| TOKINA MACRO 90mm f/2.5<br>at 1: 50 |                  |    |                  |    |
|-------------------------------------|------------------|----|------------------|----|
| f/                                  | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 2.5                                 | Excellent        | 56 | Excellent        | 45 |
| 4                                   | Excellent        | 63 | Excellent        | 50 |
| 5.6                                 | Excellent        | 63 | Excellent        | 50 |
| 8                                   | Excellent        | 63 | Excellent        | 56 |
| 11                                  | Excellent        | 70 | Excellent        | 56 |
| 16                                  | Excellent        | 63 | Excellent        | 56 |
| 22                                  | V. Good          | 50 | Excellent        | 45 |
| 32                                  | V. Good          | 45 | Excellent        | 40 |

### CONTRAST

| TOKINA MACRO 90mm f/2.5<br>at 30 lines/mm |                 |    |                 |    |
|-------------------------------------------|-----------------|----|-----------------|----|
| f/                                        | Center<br>( % ) |    | Corner<br>( % ) |    |
| 2.5                                       | High            | 59 | High            | 49 |
| 4                                         | High            | 65 | High            | 52 |
| 5.6                                       | High            | 73 | High            | 54 |
| 8                                         | High            | 81 | High            | 60 |
| 11                                        | High            | 75 | High            | 53 |
| 16                                        | High            | 66 | High            | 44 |
| 22                                        | High            | 53 | High            | 40 |
| 32                                        | High            | 47 | High            | 36 |

### MACRO RESOLUTION

| TOKINA MACRO 90mm f/2.5<br>at 1: 4 |                  |    |                  |    |
|------------------------------------|------------------|----|------------------|----|
| f/                                 | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 2.5                                | V. Good          | 45 | Excellent        | 40 |
| 4                                  | Good             | 45 | Excellent        | 45 |
| 5.6                                | Good             | 50 | Excellent        | 50 |
| 8                                  | Good             | 50 | Excellent        | 45 |
| 11                                 | V. Good          | 50 | Excellent        | 45 |
| 16                                 | Good             | 45 | Good             | 40 |
| 22                                 | Good             | 45 | Good             | 40 |
| 32                                 | Good             | 40 | Excellent        | 40 |

### MACRO RESOLUTION

| TOKINA MACRO 90mm f/2.5<br>at 1:2 |                  |    |                  |    |
|-----------------------------------|------------------|----|------------------|----|
| f/                                | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 2.5                               | Excellent        | 51 | Excellent        | 40 |
| 4                                 | Excellent        | 51 | Excellent        | 40 |
| 5.6                               | V. Good          | 51 | Excellent        | 45 |
| 8                                 | V. Good          | 57 | Excellent        | 51 |
| 11                                | V. Good          | 51 | Excellent        | 45 |
| 16                                | Good             | 45 | Good             | 40 |
| 22                                | Accept           | 40 | Accept           | 36 |
| 32                                | Accept           | 36 | Good             | 32 |

slides showed some softness but image quality was greatly improved by f/4. Detail was even, corner to corner; well rendered at apertures smaller than f/4. In macro applications, we noted extremely sharp and even corner to corner performance, even with aperture wide open. Flare may adversely affect contrast in extreme lighting situations. With adapter at 1:1 we found detail quality slightly reduced. Overall performance, above average for lenses of this type.

**Optical bench analysis** (for optical experts only): On axis, slight primary chromatic aberration gone two stops down. Diffraction limited pattern by f/8. Off axis, slight high order coma gone two stops down. Lateral color throughout. (October 1984)

## FAST-FOCUSING VIVITAR 28-85mm

**Specifications:** 28-85mm f/3.5-4.5 Vivitar Macro-Focusing Zoom; mounts for Canon,

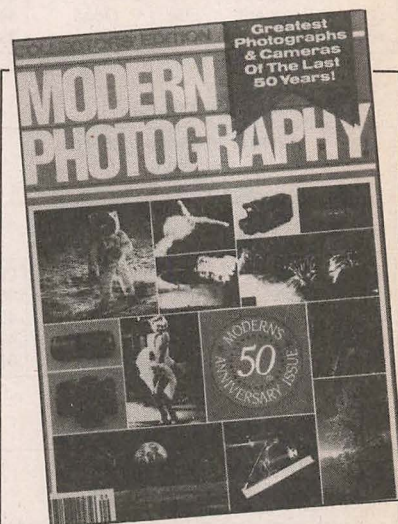
## Interchangeable Lenses

Contax/Yashica, Fujica, Konica, Minolta, Nikon, Olympus, and Pentax K; No. 77439005; accepts 62mm filters; f/3.5 (4.5) to f/16; full stop detents; min. foc. dist: 5 1/2 ft. (1.7m) in normal range at focal lengths shorter than 85mm, 2 ft. (0.6m) (max magnification 1:5) at 85mm in "macro" range; 3 1/16 in. long, 2 1/2 in. diam (102x64mm); 1 lb., 2 3/16 oz. (516g); \$259.95.

**Practical comments:** Compact, lightweight, single-touch zoom focuses to overly long 5 1/2 ft. at shortest focal lengths, down to 2 ft. at 85mm setting by turning broad (1 1/4 in.-wide), textured collar clockwise 45° to min. distance in normal mode, 60° clockwise at 85mm setting to select macro mode; collar moves forward 1/2 in. to get from 28mm to 85mm settings; very fast smooth focusing action but damping too light to hold settings well; zoom-

### PERFORMANCE

| Our Standard                                                                                                   | as Tested                               |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <b>Focal length:</b> ±5%<br>(26.60-29.40mm)<br>(80.75-89.25mm)                                                 | 28.67mm<br>82.51mm                      |
| <b>Aperture:</b> ±5%<br>(f/3.33-3.68)<br>at 85mm: (f/4.28-4.73)                                                | f/3.51<br>f/4.55                        |
| <b>Distortion:</b><br>28mm: (±2.5%)<br>85mm: (±2%)                                                             | under 1% (barrel)<br>1.85% (pincushion) |
| <b>Light falloff:</b> at f/5.6<br>+1 stop from theoretical limit<br>28mm: (0-2.0 stops)<br>85mm: (0-1.2 stops) | 1.8 stops<br>1.0 stops                  |



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## Interchangeable Lenses

### RESOLUTION

| VIVITAR 28-85mm f/3.5-4.5<br>at 28mm<br>at 1:51 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/                                              | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 3.5                                             | V. Good          | 45 | Excellent        | 32 |
| 4                                               | V. Good          | 45 | Excellent        | 32 |
| 5.6                                             | V. Good          | 51 | Excellent        | 36 |
| 8                                               | Excellent        | 57 | Excellent        | 40 |
| 11                                              | Excellent        | 57 | Excellent        | 45 |
| 16                                              | Excellent        | 51 | Excellent        | 45 |

### CONTRAST

| VIVITAR 28-85mm f/3.5-4.5<br>at 28mm<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------------------------|---------------|----|---------------|----|
| f/                                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 3.5                                                    | High          | 56 | High          | 45 |
| 4                                                      | High          | 56 | High          | 46 |
| 5.6                                                    | High          | 72 | High          | 52 |
| 8                                                      | High          | 71 | High          | 50 |
| 11                                                     | High          | 67 | High          | 49 |
| 16                                                     | High          | 54 | High          | 43 |

### RESOLUTION

| VIVITAR 28-85mm f/3.5-4.5<br>at 55mm<br>at 1:49 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/                                              | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4.2                                             | V. Good          | 49 | V. Good          | 35 |
| 5.6                                             | V. Good          | 55 | Excellent        | 44 |
| 8                                               | V. Good          | 62 | Good             | 44 |
| 11                                              | Excellent        | 62 | V. Good          | 44 |
| 16                                              | Good             | 49 | Good             | 39 |

### CONTRAST

| VIVITAR 28-85mm f/3.5-4.5<br>at 55mm<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------------------------|---------------|----|---------------|----|
| f/                                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 4.2                                                    | High          | 42 | Medium        | 29 |
| 5.6                                                    | High          | 50 | Medium        | 35 |
| 8                                                      | High          | 58 | High          | 43 |
| 11                                                     | High          | 52 | High          | 42 |
| 16                                                     | Medium        | 40 | Medium        | 35 |

### RESOLUTION

| VIVITAR 28-85mm f/3.5-4.5<br>at 85mm<br>at 1:50 |                  |    |                  |    |
|-------------------------------------------------|------------------|----|------------------|----|
| f/                                              | Center<br>(1/mm) |    | Corner<br>(1/mm) |    |
| 4.5                                             | Excellent        | 50 | Excellent        | 35 |
| 5.6                                             | Excellent        | 56 | V. Good          | 35 |
| 8                                               | V. Good          | 56 | Excellent        | 40 |
| 11                                              | Excellent        | 56 | Excellent        | 45 |
| 16                                              | V. Good          | 50 | Excellent        | 50 |

### CONTRAST

| VIVITAR 28-85mm f/3.5-4.5<br>at 85mm<br>at 30 lines/mm |               |    |               |    |
|--------------------------------------------------------|---------------|----|---------------|----|
| f/                                                     | Center<br>(%) |    | Corner<br>(%) |    |
| 4.5                                                    | High          | 43 | Medium        | 30 |
| 5.6                                                    | High          | 46 | High          | 32 |
| 8                                                      | High          | 50 | High          | 48 |
| 11                                                     | High          | 52 | High          | 45 |
| 16                                                     | High          | 49 | High          | 40 |

ing action smooth, well damped, holds settings well; nicely finished in satin black with large, legible, white-on-black footage scale, yellow-on-black macro setting, less visible green-on-black metric distance scale; dual aperture indices in red (28mm) and green (85mm) color coded to focal-length markings on barrel; red infrared focusing index; lens handles and balances nicely on compact, average-sized, and larger SLRs.

**Field test slides:** Good detail rendition and sharpness in center of images at all apertures and focal lengths, but corner images soft wide open, equal to central images at two stops down and smaller apertures; small amount of color fringing visible in corners. In photos shot directly into sun, flare at wider apertures can affect contrast. At close focusing distances (1:6) image quality satisfactory in the center, but not in corners; improves markedly at f/8 and smaller. Overall average performance for a lens of this type. Maximum magnification of 1:5 does not constitute macro focusing according to MODERN'S Test Standards which specify 1:4 or greater.

**Optical bench analysis** (for optical experts only): At 28mm on axis, slight overcorrected spherical aberration, gone by f/8; diffraction-limited pattern by f/8, yellow flare gone by f/5.6. Off axis, slight skew-ray flare, gone by f/8, some lateral color throughout. At 55mm, axial image patterns nearly identical to those at 28mm. Off axis, slight skew-ray flare mixed with astigmatism, gone by f/8, some lateral color throughout.

At 85mm on axis, slight undercorrected aberration and yellow flare to f/5.6, diffraction-limited pattern at f/8 and smaller. Off axis, coma mixed with skew-ray flare gone by f/8, some lateral color throughout. Vivitar 28-85's commendably compact and lightweight, but it only gets down to 5½ ft. at shorter focal lengths, to 2 ft. (1:5) at "macro" setting at pointer. (September 1984)

## WIDE TO LONG TELE VIVITAR ZOOM

**Specifications:** 35-200mm f/3-4.5 Macro Focusing Vivitar Zoom, No. 77402703, mounts for Nikon, Canon, Pentax, Minolta, Olympus, Ricoh, Yashica/Contax, accepts 62mm accessories; f/3-22 in full click stops; min. foc. dist.: 5¾ ft. (1.8m); 4¼ ft. (1.3m) close focus to 1:5X at 200mm setting; 5½ in. long, 2⅝ in. diam. (133 x 68.8mm); 23½ oz. (670g). Price: \$279.95.

**Practical comments:** Single touch (combined zoom and focusing collar) continuously focusing to macro at 200mm, no zoom collar creep, provides close focus (4 ft., 3-in. from film plane) at marked "macro" settings. Surprisingly large and useful maximum f/3 aperture at short focal lengths, clear markings but no depth-of-field scale, smooth focusing and zooming, satin black finish; easy to grip rubberized 3⅞-in. long zoom and focusing collar.

**Field test slides:** Generally crisp and snappy with detail well rendered. Wide open at all focal lengths, some softness in corner images, but corners equalled center sharpness at one stop down and at smaller apertures. Some light falloff in corners at 35mm and maximum aperture settings, gone completely one stop down. Flare well controlled throughout. Overall, somewhat above average performance for lens of this type.

**Optical bench analysis** (for optical experts only): At 35mm on axis, very slight overcorrected spherical aberration; diffraction limited pattern by f/5.6. Off axis, slight skew-ray flare mixed with slight astigmatism; some lateral color. At 120mm on axis, slight overcorrected spherical aberration, very slight yellow flare gone by 2 stops down from

### PERFORMANCE

| Our Standard                                                                                                     |  | as Tested              |
|------------------------------------------------------------------------------------------------------------------|--|------------------------|
| <b>Focal length: ±5%</b><br>( 33.25- 36.75mm)<br>(190.00-210.00mm)                                               |  | 35.69mm<br>197.04mm    |
| <b>Aperture: ±5%</b><br>(f/2.85-3.15)<br>at 200mm: (f/4.28-4.73)                                                 |  | f/2.97<br>f/4.66       |
| <b>Distortion:</b><br>35mm: (±2.5%) 1.15%<br>200mm: (±2.5%) 0.93%                                                |  | (pincshn)<br>(pincshn) |
| <b>Light falloff: at f/5.6</b><br>+ 1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>200mm: (0-1.0 stops) |  | 0.9 stops<br>0.7 stops |

### RESOLUTION

| VIVITAR 35-200mm f/3.0-4.5<br>at 35mm<br>at 1:49 |                      |    |                      |    |
|--------------------------------------------------|----------------------|----|----------------------|----|
| f/                                               | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 3                                                | Excellent            | 55 | Excellent            | 49 |
| 4                                                | Excellent            | 55 | Excellent            | 49 |
| 5.6                                              | Excellent            | 62 | Excellent            | 55 |
| 8                                                | Excellent            | 62 | Excellent            | 55 |
| 11                                               | Excellent            | 55 | Excellent            | 49 |
| 16                                               | Excellent            | 55 | Excellent            | 49 |
| 22                                               | V. Good              | 49 | Excellent            | 44 |

### CONTRAST

| VIVITAR 35-200mm f/3.0-4.5<br>at 35mm<br>at 30 lines/mm |            |    |            |    |
|---------------------------------------------------------|------------|----|------------|----|
| f/                                                      | Center (%) |    | Corner (%) |    |
| 3                                                       | High       | 48 | High       | 36 |
| 4                                                       | High       | 55 | High       | 45 |
| 5.6                                                     | High       | 60 | High       | 49 |
| 8                                                       | High       | 62 | High       | 52 |
| 11                                                      | High       | 61 | High       | 53 |
| 16                                                      | High       | 59 | High       | 49 |
| 22                                                      | High       | 44 | Medium     | 36 |

### RESOLUTION

| VIVITAR 35-200mm f/3.0-4.5<br>at 120mm<br>at 1:50 |                      |    |                      |    |
|---------------------------------------------------|----------------------|----|----------------------|----|
| f/                                                | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4                                                 | Excellent            | 56 | Excellent            | 50 |
| 5.6                                               | Excellent            | 63 | Excellent            | 56 |
| 8                                                 | Excellent            | 63 | Excellent            | 56 |
| 11                                                | Excellent            | 56 | Excellent            | 50 |
| 16                                                | Excellent            | 56 | Excellent            | 50 |
| 22                                                | V. Good              | 50 | Excellent            | 45 |

### CONTRAST

| VIVITAR 35-200mm f/3.0-4.5<br>at 120mm<br>at 30 lines/mm |            |    |            |    |
|----------------------------------------------------------|------------|----|------------|----|
| f/                                                       | Center (%) |    | Corner (%) |    |
| 4                                                        | High       | 53 | High       | 39 |
| 5.6                                                      | High       | 61 | High       | 50 |
| 8                                                        | High       | 63 | High       | 52 |
| 11                                                       | High       | 58 | High       | 48 |
| 16                                                       | High       | 49 | High       | 40 |
| 22                                                       | Medium     | 38 | Medium     | 35 |



## RESOLUTION

| VIVITAR 35-200mm f/3.0-4.5<br>at 200mm<br>at 1:51 |                      |    |                      |    |
|---------------------------------------------------|----------------------|----|----------------------|----|
| f/                                                | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 4.5                                               | Excellent            | 57 | Excellent            | 51 |
| 5.6                                               | Excellent            | 64 | Excellent            | 57 |
| 8                                                 | Excellent            | 64 | Excellent            | 57 |
| 11                                                | Excellent            | 57 | Excellent            | 51 |
| 16                                                | Excellent            | 57 | Excellent            | 51 |
| 22                                                | Excellent            | 51 | Excellent            | 45 |

## CONTRAST

| VIVITAR 35-200mm f/3.0-4.5<br>at 200mm<br>at 30 lines/mm |            |    |            |    |
|----------------------------------------------------------|------------|----|------------|----|
| f/                                                       | Center (%) |    | Corner (%) |    |
| 4.5                                                      | High       | 55 | High       | 43 |
| 5.6                                                      | High       | 51 | High       | 50 |
| 8                                                        | High       | 63 | High       | 61 |
| 11                                                       | High       | 58 | High       | 49 |
| 16                                                       | High       | 49 | High       | 39 |
| 22                                                       | Medium     | 39 | Medium     | 34 |

maximum aperture; diffraction limited by f/8. Off axis, very slight skew-ray flare mixed with slight astigmatism; some lateral color throughout. At 200mm on axis, slight overcorrected spherical aberration, very slight red flare gone by f/8; diffraction limited pattern at f/8 and smaller apertures. Off axis, slight coma mixed with astigmatism, some lateral color. (October 1985)

## VIVITAR GETS TO 1:3.6

**Specifications:** 70-200mm f/3.8 Macro Focusing Vivitar Zoom, No. 42003810, mounts for Nikon, Canon, Pentax, Minolta, Olympus, Yashica/Contax; accepts 58mm accessories; f/3.8-22 in half stop click detents; min. foc. dist.: 3 1/2 ft. (1.1m) throughout zoom range, 1:4X macro at 200mm focal length; 4 3/4-in. long, 2 5/8-in. diam. (123 x 67mm); 21 oz. (590g). Price: \$199.95.

**Practical comments:** Nicely made budget-priced zoom (actual selling price way below shown list) uses many plastic barrel parts in non-critical areas. A slightly stiff, adequately smooth combined 2-in. long rubberized zoom and focusing collar has no zoom creep; no depth-of-field scale, numerals very legible, satin black finish.

**Field test slides:** Slides generally crisp and contrasty with fine detail well rendered at all focal lengths. Some color fringing seen in images shot at maximum aperture at 70mm, but gone by f/8. Slight softness in corner im-

## PERFORMANCE

| Our Standard                                                                                                    | as Tested                       |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>Focal length: ±5%</b><br>( 66.50- 73.50mm)<br>(190.00-210.00mm)                                              | 66.80mm<br>197.80mm             |
| <b>Aperture: ±5%</b><br>(f/3.61-3.99)<br>at 200mm: (f/3.61-3.99)                                                | f/3.61<br>f/3.97                |
| <b>Distortion:</b><br>70mm: (±2%)<br>200mm: (±2.5%)                                                             | 0.66% barrel<br>1.85% (pincshn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>70mm: (0-1.3 stops)<br>200mm: (0-1.0 stops) | 0.5 stops<br>0.6 stops          |

## RESOLUTION

| VIVITAR 70-200mm f/3.8<br>at 70mm<br>at 1:49 |                      |    |                      |    |
|----------------------------------------------|----------------------|----|----------------------|----|
| f/                                           | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 3.8                                          | Excellent            | 55 | Excellent            | 49 |
| 5.6                                          | Excellent            | 62 | Excellent            | 55 |
| 8                                            | Excellent            | 69 | Excellent            | 62 |
| 11                                           | Excellent            | 62 | Excellent            | 55 |
| 16                                           | V. Good              | 55 | Excellent            | 49 |
| 22                                           | V. Good              | 55 | Excellent            | 49 |

## CONTRAST

| VIVITAR 70-200mm f/3.8<br>at 70mm<br>at 30 lines/mm |            |    |            |    |
|-----------------------------------------------------|------------|----|------------|----|
| f/                                                  | Center (%) |    | Corner (%) |    |
| 3.8                                                 | High       | 42 | Medium     | 31 |
| 5.6                                                 | High       | 56 | High       | 45 |
| 8                                                   | High       | 61 | High       | 50 |
| 11                                                  | High       | 56 | High       | 44 |
| 16                                                  | High       | 49 | High       | 39 |
| 22                                                  | Medium     | 38 | Medium     | 34 |

## RESOLUTION

| VIVITAR 70-200mm f/3.8<br>at 130mm<br>at 1:50 |                      |    |                      |    |
|-----------------------------------------------|----------------------|----|----------------------|----|
| f/                                            | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 3.8                                           | Excellent            | 56 | Excellent            | 50 |
| 5.6                                           | Excellent            | 63 | Excellent            | 56 |
| 8                                             | Excellent            | 63 | Excellent            | 56 |
| 11                                            | Excellent            | 56 | Excellent            | 50 |
| 16                                            | Excellent            | 56 | Excellent            | 50 |
| 22                                            | V. Good              | 50 | Excellent            | 45 |

## CONTRAST

| VIVITAR 70-200mm f/3.8<br>at 130mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 3.8                                                  | High       | 43 | Medium     | 31 |
| 5.6                                                  | High       | 58 | High       | 46 |
| 8                                                    | High       | 62 | High       | 52 |
| 11                                                   | High       | 55 | High       | 45 |
| 16                                                   | High       | 48 | High       | 38 |
| 22                                                   | Medium     | 38 | Medium     | 32 |

## RESOLUTION

| VIVITAR 70-200mm f/3.8<br>at 200mm<br>at 1:50 |                      |    |                      |    |
|-----------------------------------------------|----------------------|----|----------------------|----|
| f/                                            | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 3.8                                           | Excellent            | 56 | Excellent            | 50 |
| 5.6                                           | Excellent            | 63 | Excellent            | 56 |
| 8                                             | Excellent            | 63 | Excellent            | 56 |
| 11                                            | Excellent            | 56 | Excellent            | 50 |
| 16                                            | Excellent            | 56 | Excellent            | 50 |
| 22                                            | Excellent            | 50 | Excellent            | 45 |

## CONTRAST

| VIVITAR 70-200mm f/3.8<br>at 200mm<br>at 30 lines/mm |            |    |            |    |
|------------------------------------------------------|------------|----|------------|----|
| f/                                                   | Center (%) |    | Corner (%) |    |
| 3.8                                                  | High       | 45 | High       | 32 |
| 5.6                                                  | Medium     | 37 | High       | 46 |
| 8                                                    | High       | 62 | High       | 51 |
| 11                                                   | High       | 56 | High       | 45 |
| 16                                                   | High       | 47 | High       | 39 |
| 22                                                   | Medium     | 38 | Medium     | 32 |

## Interchangeable Lenses

### MACRO RESOLUTION

| VIVITAR 70-200mm f/3.8<br>at 200mm<br>at 1:4 |                      |    |                      |    |
|----------------------------------------------|----------------------|----|----------------------|----|
| f/                                           | Center<br>(Lines/mm) |    | Corner<br>(Lines/mm) |    |
| 3.8                                          | Excellent            | 45 | Excellent            | 40 |
| 5.6                                          | Excellent            | 45 | Excellent            | 40 |
| 8                                            | Excellent            | 51 | Excellent            | 45 |
| 11                                           | Excellent            | 45 | Excellent            | 40 |
| 16                                           | Excellent            | 45 | Excellent            | 40 |
| 22                                           | V. Good              | 40 | V. Good              | 36 |

ages noticeable wide open at all focal lengths but corner sharpness equalled center by f/8. Flare well controlled throughout. Overall, slightly above average performance for lens of this type.

**Optical bench analysis** (for optical experts only): At 70mm on axis, slight overcorrected spherical aberration with very slight yellow flare, both gone by f/5.6. Diffraction limited pattern by f/16. Off axis, slight coma mixed with slight astigmatism; some lateral color.

At 130mm on axis, same comments as at 70mm; diffraction limited pattern by f/11. Off axis, slight skew-ray flare mixed with slight astigmatism; some lateral color.

At 200mm, on axis, slight overcorrected spherical aberration, very slight red-yellow flare, gone 3 stops down; diffraction limited pattern by f/16. Off axis, slight coma mixed with slight skew-ray flare, lateral color throughout. (October 1985)

## 120-600mm f/5.6-8 VIVITAR TELE ZOOM

**Specifications:** 120-600mm f/5.6-8 Vivitar Tele Zoom, No. 77401676, in mounts for Canon, Nikon AIS, Minolta MD, Pentax KA, Olympus, Konica, Yashica/Contax; accepts 82mm filters; f/5.6-f/32 (f/8-f/45 at 600mm) with full stop detents; min. foc. dist. 13ft. (4m); built-in sun shade, 90° turning, locking collar and tripod mount with dual threads; 11 1/4-in. long, 3 1/2-in. diam. (285 x 89mm); 5 lbs. (2255g). \$739.95.

**Practical comments:** Wide, easily gripped, smoothly turning rubberized rings operate two touch controls (but it's possible to zoom and focus simultaneously by pushing focus ring back and forth while turning it to focus), large, legible markings, tripod mounting strongly recommended.

**Field test slides:** Transparencies showed good contrast and crisp images. At 120mm, corners equalled center sharpness by f/8. At 300mm, sharpness improved considerably with corners equalling center quality at one stop smaller than maximum aperture. At

## PERFORMANCE

| Our Standard                                                                                                   | as Tested                          |
|----------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length: ±5%</b><br>(114.00-126.00mm)<br>(570.00-630.00mm)                                             | 125.05mm<br>593.25mm               |
| <b>Aperture: ±5%</b><br>(f/5.32-5.88)<br>at 600mm: (f/7.60-8.40)                                               | f/5.78<br>f/8.38                   |
| <b>Distortion:</b><br>120mm: (±2.5%)<br>600mm: (±3.5%)                                                         | 0.92% (pincshn)<br>0.44% (pincshn) |
| <b>Light falloff: at f/8</b><br>+1 stop from theoretical limit<br>120mm: (0-1.1 stops)<br>600mm: (0-1.0 stops) | 0.6 stops<br>0.9 stops             |



## Interchangeable Lenses

### RESOLUTION

| VIVITAR 120-600mm f/5.6-8<br>at 120mm<br>at 1:50 |               |    |               |    |
|--------------------------------------------------|---------------|----|---------------|----|
| f/                                               | Center (l/mm) |    | Corner (l/mm) |    |
| 5.6                                              | Excellent     | 50 | Excellent     | 45 |
| 8                                                | Excellent     | 56 | Excellent     | 50 |
| 11                                               | Excellent     | 56 | Excellent     | 50 |
| 16                                               | V. Good       | 50 | Excellent     | 45 |
| 22                                               | V. Good       | 50 | Excellent     | 45 |
| 32                                               | V. Good       | 45 | Excellent     | 40 |

### CONTRAST

| VIVITAR 120-600mm f/5.6-8<br>at 120mm<br>at 30 lines/mm |            |    |            |    |
|---------------------------------------------------------|------------|----|------------|----|
| f/                                                      | Center (%) |    | Corner (%) |    |
| 5.6                                                     | High       | 44 | High       | 34 |
| 8                                                       | High       | 58 | High       | 44 |
| 11                                                      | High       | 61 | High       | 49 |
| 16                                                      | High       | 59 | High       | 45 |
| 22                                                      | High       | 45 | Medium     | 33 |
| 32                                                      | High       | 34 | Medium     | 29 |

### RESOLUTION

| VIVITAR 120-600mm f/5.6-8<br>at 300mm<br>at 1:50 |                   |    |                   |    |
|--------------------------------------------------|-------------------|----|-------------------|----|
| f/                                               | Center (Lines/mm) |    | Corner (Lines/mm) |    |
| 6.7                                              | Excellent         | 50 | Excellent         | 45 |
| 8                                                | Excellent         | 56 | Excellent         | 50 |
| 11                                               | Excellent         | 56 | Excellent         | 50 |
| 16                                               | Excellent         | 50 | Excellent         | 45 |
| 22                                               | Excellent         | 50 | Excellent         | 45 |
| 32                                               | Excellent         | 45 | Excellent         | 40 |

### CONTRAST

| VIVITAR 120-600mm f/5.6-8<br>at 300mm<br>at 30 lines/mm |            |    |            |    |
|---------------------------------------------------------|------------|----|------------|----|
| f/                                                      | Center (%) |    | Corner (%) |    |
| 6.7                                                     | Medium     | 36 | High       | 32 |
| 8                                                       | High       | 43 | High       | 41 |
| 11                                                      | High       | 45 | High       | 42 |
| 16                                                      | Medium     | 39 | High       | 37 |
| 22                                                      | Low        | 33 | Medium     | 32 |
| 32                                                      | Medium     | 31 | Medium     | 29 |

### RESOLUTION

| VIVITAR 120-600mm f/5.6-8<br>at 600mm<br>at 1:34 |                   |    |                   |    |
|--------------------------------------------------|-------------------|----|-------------------|----|
| f/                                               | Center (Lines/mm) |    | Corner (Lines/mm) |    |
| 8                                                | Good              | 34 | V. Good           | 30 |
| 11                                               | Good              | 38 | Good              | 34 |
| 16                                               | Good              | 38 | Good              | 34 |
| 22                                               | Accept            | 34 | Accept            | 30 |
| 32                                               | Good              | 30 | Good              | 27 |

### CONTRAST

| VIVITAR 120-600mm f/5.6-8<br>at 600mm<br>at 30 lines/mm |            |    |            |    |
|---------------------------------------------------------|------------|----|------------|----|
| f/                                                      | Center (%) |    | Corner (%) |    |
| 8                                                       | V. Low     | 15 | V. Low     | 11 |
| 11                                                      | V. Low     | 15 | V. Low     | 12 |
| 16                                                      | V. Low     | 18 | V. Low     | 14 |
| 22                                                      | V. Low     | 20 | V. Low     | 16 |
| 32                                                      | V. Low     | 17 | V. Low     | 16 |

600mm, image sharpness improved at two stops smaller than maximum opening. Flare was well controlled. Average to above average performance for this tele zoom lens.

**Optical bench analysis** (for optical experts only): At 120mm, on axis, slight under-corrected spherical aberration could be seen with very slight red flare. Off axis, there was very slight astigmatism with no lateral color.

At 300mm, on axis, the image appeared much as at 120mm. Off axis, slight red-green lateral color was present along with slight astigmatism. Images were much improved by f/11.

At 600mm, on axis, much the same condition existed as at other focal lengths. Off axis, again there was slight red-green lateral color along with slight coma. Images were again much improved by f/11. (March 1986)

## YASHICA'S 35-70 AF: GOOD PERFORMER

**Specifications:** 35-70mm f/3.3-4.5 Yashica AF in Kyocera/Yashica AF mount, accepts 52mm accessories; f/3.3 to f/22; min. foc. dist.: 1.1 ft.; maximum magnification 1:4; 8 elements in 7 groups, 2 5/8 x 2 15/16 inches, 8 3/16 ounces (251g). \$220.

**Comments:** Black plastic body with wide, rubberized-grip zoom ring. Focal lengths clearly marked in white. Distance scale behind window in front of lens; footage marked in orange, metric in white. Only half of a depth-of-field scale is shown, marked in red and oriented to focal length, not aperture settings. Autofocusing is quick. Manual focusing ring is a thin, plastic serrated disc at front of lens. Manual focusing action is undampened with a rather insubstantial feel. Lens does not have aperture ring. Red raised dot aligns bayonet mount for quick quarter-turn lens coupling.

**Field test slides:** The transparencies were snappy and crisp with well-rendered detail. Corners at 35mm were slightly soft until f/8, when they equaled center sharpness. Very slight barrel distortion. At 50mm and 70mm, the corners equaled center sharpness at f/11, with slight pincushion effect at 70mm. Light falloff while shooting wide open at all focal lengths almost disappeared after closing down one stop. Flare was well-controlled throughout. Macro quality was adequate for this type of lens. Overall, an average performer.

**Optical bench analysis:** At 35mm, on-axis, very slight overcorrected spherical aberration with very slight red flare, gone by f/4.5. Diffraction limited by f/16. Off-axis, very slight skew-ray flare was mixed with a very slight astigmatism, diminished by f/16. Lateral color present.

At 50mm, on-axis, very slight overcorrected spherical aberration with very slight red/yellow flare, gone by f/8. Diffraction limited by f/16. Off-axis, very slight astigmatism mixed with very slight red flare, almost gone by f/16. Lateral color minimal.

At 70mm, on-axis, very slight overcorrected spherical aberration with

very slight red flare gone by f/8. Diffraction limited by f/16. Off-axis, very slight coma mixed with very slight astigmatism almost gone by f/16. Lateral color present.

### PERFORMANCE

| Our Standard                                                                                                   |  | As Tested |
|----------------------------------------------------------------------------------------------------------------|--|-----------|
| <b>Focal length: ±5%</b><br>(33.25-36.75mm)<br>(66.50-73.50mm)                                                 |  |           |
| 36.60mm                                                                                                        |  |           |
| 68.78mm                                                                                                        |  |           |
| <b>Aperture: ±5%</b><br>(f/3.14-3.47)<br>at 70mm: (f/4.28-4.73)                                                |  |           |
| f/3.33                                                                                                         |  |           |
| f/4.73                                                                                                         |  |           |
| <b>Distortion:</b><br>35mm: (± 2.5%)<br>70mm: (±2%)                                                            |  |           |
| 1.6% (barrel)                                                                                                  |  |           |
| 1.1% (pinch)                                                                                                   |  |           |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>70mm: (0-1.3 stops) |  |           |
| 0.5 stops                                                                                                      |  |           |
| 0.2 stops                                                                                                      |  |           |

### RESOLUTION

| YASHICA AF 35-70mm f/3.3-4.5<br>at 35mm/1:49 |               |    |               |    |
|----------------------------------------------|---------------|----|---------------|----|
| f/                                           | Center (l/mm) |    | Corner (l/mm) |    |
| 3.3                                          | Accept        | 39 | Excellent     | 35 |
| 5.6                                          | Good          | 44 | Excellent     | 39 |
| 8                                            | Good          | 49 | Excellent     | 44 |
| 11                                           | Excellent     | 55 | Excellent     | 49 |
| 16                                           | V. Good       | 49 | Excellent     | 44 |
| 22                                           | V. Good       | 44 | Excellent     | 39 |

#### at 50mm/1:50

| f/  | Center (l/mm) |    | Corner (l/mm) |    |
|-----|---------------|----|---------------|----|
| 4   | V. Good       | 45 | Excellent     | 40 |
| 5.6 | V. Good       | 50 | Excellent     | 45 |
| 8   | V. Good       | 56 | Excellent     | 50 |
| 11  | V. Good       | 50 | Excellent     | 45 |
| 16  | V. Good       | 50 | V. Good       | 40 |
| 22  | Good          | 45 | V. Good       | 40 |

#### at 70mm/1:50

| f/  | Center (l/mm) |    | Corner (l/mm) |    |
|-----|---------------|----|---------------|----|
| 4.5 | V. Good       | 45 | Excellent     | 40 |
| 5.6 | V. Good       | 50 | Excellent     | 45 |
| 8   | V. Good       | 56 | Excellent     | 50 |
| 11  | V. Good       | 50 | Excellent     | 45 |
| 16  | Good          | 45 | Excellent     | 40 |
| 22  | Good          | 45 | Excellent     | 40 |

### CONTRAST

| at 35mm/30 lines/mm |            |    |            |    |
|---------------------|------------|----|------------|----|
| f/                  | Center (%) |    | Corner (%) |    |
| 3.3                 | Medium     | 34 | Low        | 18 |
| 5.6                 | High       | 47 | Low        | 19 |
| 8                   | Medium     | 48 | Low        | 21 |
| 11                  | Medium     | 42 | Low        | 23 |
| 16                  | Medium     | 37 | V. Low     | 19 |
| 22                  | V. Low     | 23 | V. Low     | 16 |

#### at 50mm/30 lines/mm

| f/  | Center (%) |    | Corner (%) |    |
|-----|------------|----|------------|----|
| 4   | Medium     | 34 | Low        | 20 |
| 5.6 | Medium     | 42 | Low        | 24 |
| 8   | Medium     | 45 | Low        | 22 |
| 11  | High       | 55 | Low        | 24 |
| 16  | Low        | 35 | V. Low     | 20 |
| 22  | V. Low     | 27 | V. Low     | 16 |

#### at 70mm/30 lines/mm

| f/  | Center (%) |    | Corner (%) |    |
|-----|------------|----|------------|----|
| 4.5 | Medium     | 31 | Medium     | 25 |
| 5.6 | High       | 47 | High       | 33 |
| 8   | Medium     | 49 | Medium     | 34 |
| 11  | High       | 45 | Medium     | 32 |
| 16  | Medium     | 38 | Low        | 28 |
| 22  | V. Low     | 24 | V. Low     | 19 |



## CANON 80-200mm f/4L MACRO ZOOM

**Specifications:** 80–200mm f/4L Canon FD. No. 10619 in Canon FD mount, accepts 58mm accessories; f/4–32 plus locked "A" (autoexposure) setting; half-stop detents throughout; min. foc. dist.: 37 in. (0.95m) in macro setting to 1:3 magnification at 200mm, 47 in. (1.2m) in normal close mode; continuous focusing from infinity to macro; 14 elements (including one fluorite and one UD, ultra-low dispersion element), 12 groups; 6 in. long, 3 1/16 in. diam. (53mmx75mm); 1 lb. 7 oz. (675g). \$619.

**Practical comments:** Moderately large and heavy for this focal range. This 80–200mm bears Canon's L designation, denoting a top-of-the-line lens built to extremely high tolerances. Wide, comfortable (in. long) rubberized one-touch zoom/focus ring is easy to manipulate, has smooth, well damped action, no slippage when lens is pointing up or down. Excellent satin black finish; focuses from infinity to min. macro foc. dist. in smooth 240° clockwise turn; all scales are legible in white-on-black except green-on-black footage scale.

**Field test slides:** Transparencies were crisp and snappy with detail well rendered. At maximum aperture, very slight softness was noted in corners. By one stop down, corners almost equalled center sharpness. Very slight light falloff observed wide open was gone by one stop down. Flare well-controlled throughout, but under extreme conditions, there may be a slight loss of overall contrast. Macro quality, above average for this type of zoom, improves as you stop down. Overall, above average performance for a lens of this type.

**Optical bench analysis** (for optical experts only): On axis, at 80mm, slight overcorrected spherical aberration. Near diffraction limit by f/8. Off axis, slight coma, no lateral color. On axis at 135mm, slight overcorrected spherical aberration at f/5.6 improved at f/8. Diffraction limit was reached by f/8. Off axis, very slight coma, slight astigmatism, no lateral color. At 200mm on axis, compact image; no color. Diffraction limited was reached by f/11. Off axis, very slight coma. Overall color and other aberrations were extremely well corrected.

### PERFORMANCE

| Our Standard                                                                                                    | as Tested                         |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Focal length: ±5%</b><br>(76.00–84.00mm)<br>(190.00–210.00mm)                                                | 82.53mm<br>198.03mm               |
| <b>Aperture: ±5%</b><br>(f/3.80–4.20)<br>at 200mm: (f/3.80–4.20)                                                | f/4.06<br>f/4.19                  |
| <b>Distortion:</b><br>80mm: (±2%)<br>200mm: (±2.5%)                                                             | 0.44% (barrel)<br>1.4% (pincushn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>80mm: (0–1.2 stops)<br>200mm: (0–1.0 stops) | 0.8 stops<br>0.6 stops            |

### RESOLUTION

#### CANON 80-200mm f/4 L at 80mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4   | Excellent     | 56            |
| 5.6 | Excellent     | 63            |
| 8   | Excellent     | 70            |
| 11  | Excellent     | 70            |
| 16  | Excellent     | 63            |
| 22  | Excellent     | 56            |
| 32  | Excellent     | 50            |

#### at 135mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4   | Excellent     | 56            |
| 5.6 | Excellent     | 63            |
| 8   | Excellent     | 70            |
| 11  | Excellent     | 70            |
| 16  | Excellent     | 63            |
| 22  | Excellent     | 56            |
| 32  | Excellent     | 50            |

#### at 200mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4   | Excellent     | 50            |
| 5.6 | Excellent     | 56            |
| 8   | Excellent     | 63            |
| 11  | Excellent     | 70            |
| 16  | Excellent     | 63            |
| 22  | Excellent     | 56            |
| 32  | Excellent     | 50            |

### MACRO RESOLUTION

#### CANON 80-200mm f/4 L at 200mm/1:4

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4   | V. Good       | 36            |
| 5.6 | Excellent     | 40            |
| 8   | V. Good       | 45            |
| 11  | Excellent     | 45            |
| 16  | V. Good       | 40            |
| 22  | Good          | 36            |
| 32  | Good          | 32            |

### CONTRAST

#### CANON 80-200mm f/4 L at 80mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4   | High       | 48         |
| 5.6 | High       | 60         |
| 8   | High       | 62         |
| 11  | High       | 62         |
| 16  | High       | 50         |
| 22  | High       | 43         |
| 32  | Medium     | 32         |

#### at 135mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4   | High       | 50         |
| 5.6 | High       | 62         |
| 8   | High       | 62         |
| 11  | High       | 62         |
| 16  | High       | 48         |
| 22  | High       | 42         |
| 32  | High       | 34         |

#### at 200mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4   | High       | 44         |
| 5.6 | High       | 56         |
| 8   | High       | 60         |
| 11  | High       | 60         |
| 16  | High       | 45         |
| 22  | Medium     | 35         |
| 32  | Low        | 28         |

## PAIR OF WIDE ANGLE ZOOMS FROM CHINON

**Specifications:** 28–70mm f/2.8–4.2 Chinon Zoom, No. 410019, in Pentax K bayonet mount; accepts 72mm accessories; f/2.8 (4.2) to f/22; (click detents at all full stops); min. foc. dist.: 16 in. (.5m) in normal mode, 5 in. (.15m) in macro mode; 1:3 magnification at 70mm; 3 1/2-in. long, 2 1/8-in. diam. (89x73mm), 16 oz. (452g). \$299.95.

**Specifications:** 35–105mm f/3.5–4.5 Chinon Zoom, No. 8500442, in Pentax K bayonet mount accepts 55mm accessories; f/3.5 (4.5) to f/22; click detents at half stops

## Interchangeable Lenses

except between f/16 and f/22; min. foc. dist. 4 ft. 6 in. (1.4m) in normal mode, 2 ft. 3 in. (7m) in macro mode; 1:4 magnification at 105mm; 3 3/8 in. long 2 1/4 in. diam. (86x57mm); 16 1/8 oz. (455g), \$369.95.

**Practical comments:** Well-made matte-black finished barrels; 28–70mm has large, legible white-on-black aperture, metric distance and focal length scales, orange footage scale; separate smooth-operating zoom (1/2 in. wide) and focusing (1 in. wide) control rings; thinly ribbed aperture setting ring is more difficult to operate; continuous focus to macro at all focal lengths with only a 90° clockwise turn needed to go from infinity to min. foc. distance.

The 35–105mm is extremely compact and lightweight, all scales (white-on-black aperture and metric, orange footage) are smaller but equally legible; 1 3/4 in. wide texturized rubber ring for combined zoom and focus controls operates smoothly; holds settings well without slippage when held vertically; aperture ring is raised slightly for easy gripping and rotation; continuous focusing to macro at 105mm only with 90° clockwise turn needed to go from infinity to standard min. foc. distance.

**Field test slides:** Slides shot with 28–70mm lens were crisp and snappy overall. Corner sharpness at 28mm and maximum aperture was not equal to center but improved by two stops down. Very slight color fringing noticeable in corners. Barrel distortion noted. At 50mm and 70mm, corner sharpness equalled center by two stops down. Flare well controlled throughout. Overall, an average lens for this type of zoom.

Test slides shot with the 35–105mm lens were crisp and snappy overall, showing well-rendered detail; at 35mm sharpness increased by one stop down and held through all apertures. Barrel distortion noted. At 50mm, sharpness also increased by one stop down. At 105mm, corner sharpness was equal to center by one stop down. Very slight pincushion distortion seen. Flare was well controlled throughout. Overall average performance for a lens of this type.

**Optical bench analysis** (for optical experts only): At 28mm, on axis, 28–70mm showed very slight undercorrected spherical aberration; very slight axial color disappeared by f/5.6; diffraction limit was reached by f/11. Off axis, very slight coma mixed with very slight astigmatism was seen; lateral color present.

At 50mm, on axis, very slight overcorrected spherical aberration noted; slight axial color present but disappeared by f/8, diffraction limit was reached by f/16. Off axis, slight coma mixed with slight skew-ray flare seen lateral color present.

At 70mm, on axis, very slight undercorrected spherical aberration seen, slight axial color noted but gone by f/8; diffraction limit was reached by f/16. Off axis, slight skewray flare mixed with slight astigmatism, lateral color present.

35–105mm, at 35mm, on axis, very slight overcorrected spherical aberration present; slight red flare seen but disappeared by f/8, diffraction limit was reached by f/11. Off axis, very slight coma mixed with skew-ray flare seen lateral color present.

At 105mm, on axis, very slight overcorrected spherical aberration present, diffraction limit was reached by f/16. Off axis, very slight skew-ray flare mixed with slight astigmatism; lateral color present.



## Interchangeable Lenses

### PERFORMANCE

| Our Standard                                                                                                   | as Tested                          |
|----------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length: ±5%</b><br>(26.60-29.40mm)<br>(66.50-73.50mm)                                                 | 28.67mm<br>68.02mm                 |
| <b>Aperture: ±5%</b><br>(f/2.66-2.94)<br>at 70 mm: (f/3.99-4.41)                                               | f/2.83<br>f/4.41                   |
| <b>Distortion:</b><br>28mm: (±2.5%)<br>70mm: (±2%)                                                             | 1.89% (barrel)<br>0.96% (pincushn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>28mm: (0-2.0 stops)<br>70mm: (0-1.3 stops) | 1.8 stops<br>0.4 stops             |

### RESOLUTION

#### CHINON 28-70mm f/2.8-4.2 at 28mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 2.8 | V. Good       | 45 Excellent 40 |
| 4   | Excellent     | 50 Excellent 45 |
| 5.6 | V. Good       | 50 Excellent 45 |
| 8   | Excellent     | 56 Excellent 50 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | Excellent     | 50 Excellent 45 |
| 22  | Excellent     | 50 Excellent 45 |

#### at 50mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 3.5 | Excellent     | 50 Excellent 45 |
| 4   | V. Good       | 50 Excellent 45 |
| 5.6 | V. Good       | 56 Excellent 50 |
| 8   | V. Good       | 56 Excellent 50 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | V. Good       | 50 Excellent 45 |
| 22  | V. Good       | 50 Excellent 45 |

#### at 70mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4.2 | Excellent     | 50 Excellent 45 |
| 5.6 | V. Good       | 50 Excellent 45 |
| 8   | V. Good       | 56 Excellent 50 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | V. Good       | 50 Excellent 45 |
| 22  | V. Good       | 50 Excellent 45 |

### CONTRAST

#### CHINON 28-70mm f/2.8-4.2 at 28mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 2.8 | High       | 40 High 36   |
| 4   | High       | 46 High 40   |
| 5.6 | High       | 56 High 49   |
| 8   | High       | 64 High 53   |
| 11  | High       | 58 High 40   |
| 16  | High       | 48 Medium 35 |
| 22  | Medium     | 40 Medium 31 |

#### at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 3.5 | High       | 43 High 40   |
| 4   | High       | 48 High 42   |
| 5.6 | High       | 59 High 48   |
| 8   | High       | 65 High 55   |
| 11  | High       | 59 High 47   |
| 16  | Medium     | 46 Medium 38 |
| 22  | Medium     | 40 Low 30    |

#### at 70mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 4.2 | High       | 47 High 38   |
| 5.6 | High       | 58 High 48   |
| 8   | High       | 64 High 51   |
| 11  | High       | 57 High 49   |
| 16  | High       | 47 High 38   |
| 22  | High       | 40 Medium 30 |

### PERFORMANCE

| Our Standard                                                                                                    | as Tested                          |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length: ±5%</b><br>(33.25- 36.75mm)<br>(99.75-110.25mm)                                                | 35.69mm<br>102.79mm                |
| <b>Aperture: ±5%</b><br>(f/3.33-3.68)<br>at 105mm: (f/4.28-4.73)                                                | f/3.48<br>f/4.46                   |
| <b>Distortion:</b><br>35mm: (±2.5%)<br>105mm: (±2.5%)                                                           | 0.97% (barrel)<br>1.47% (pincushn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>105mm: (0-1.1 stops) | 0.8 stops<br>0.6 stops             |

### RESOLUTION

#### CHINON 35-105mm f/3.5-4.5 at 35mm/1:51

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 3.5 | V. Good       | 45 Excellent 40 |
| 5.6 | Excellent     | 51 Excellent 45 |
| 8   | Excellent     | 57 Excellent 51 |
| 11  | Excellent     | 57 Excellent 51 |
| 16  | Excellent     | 51 Excellent 45 |
| 22  | V. Good       | 45 Excellent 40 |

#### at 50mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4   | V. Good       | 45 Excellent 40 |
| 5.6 | V. Good       | 50 Excellent 45 |
| 8   | V. Good       | 56 Excellent 50 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | V. Good       | 50 Excellent 45 |
| 22  | Good          | 45 V. Good 40   |

#### at 105mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4.5 | Excellent     | 50 Excellent 45 |
| 5.6 | V. Good       | 50 Excellent 45 |
| 8   | V. Good       | 56 Excellent 50 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | V. Good       | 50 Excellent 45 |
| 22  | Good          | 45 Excellent 40 |

### CONTRAST

#### CHINON 35-105mm f/3.5-4.5 at 35mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 3.5 | High       | 44 High 34   |
| 5.6 | High       | 54 High 43   |
| 8   | High       | 63 High 52   |
| 11  | High       | 66 High 55   |
| 16  | High       | 53 High 41   |
| 22  | Medium     | 42 Medium 31 |

#### at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4   | High       | 50 High 41 |
| 5.6 | High       | 60 High 49 |
| 8   | High       | 62 High 51 |
| 11  | High       | 64 High 52 |
| 16  | High       | 53 High 42 |
| 22  | Medium     | 42 Low 30  |

#### at 105mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 4.5 | High       | 53 High 41   |
| 5.6 | High       | 57 High 47   |
| 8   | High       | 63 High 52   |
| 11  | High       | 64 High 55   |
| 16  | High       | 52 High 40   |
| 22  | High       | 41 Medium 30 |

## A PAIR OF WIDE-ANGLE TO TELE COSINAS

**Specifications:** 28-135mm f/4 Cosina, No. FD95315609 available in most SLR mounts (except AF), accepts 67mm accessories; f/4 (5.6) to f/22, click detents at full stops; min. foc. dist.: 7 ft. in normal mode, 1:4 magnification at 135mm. 3.75 in. long, 70mm in diam.; 20 oz. \$379.90.

**Specifications:** 28-200mm f/3.8-5.6 Cosina, No. FD96200932 available in most SLR mounts (except AF), accepts 72mm accessories; f/3.8 (5.6) to f/22, click stops at full stop intervals; min. foc. dist.: 10 ft. (2.5m) to 1:4 in macro; 4.8 in. long, 75mm in diam.; 23 oz. \$439.90.

**Practical comments:** 28-135mm is of average size and weight. Well-made matte black finished barrel has large, legible lettering. White-on-black numerals for aperture, metric distance and focal length scale, bright green for footages, A setting and 135mm indication on barrel. Yellow indicates macro. Two-in. textured rubberized focus/focal length ring moves quickly over 1 in. from 28mm to 135mm with some roughness in macro and in infinity when changing focal lengths. Zoom tends to slip when lens is held vertically. 1/4 in. ribbed metal aperture ring operates somewhat stiffly in full-aperture click stops. Macro focus requires a 180° clockwise turn, although infinity to minimum normal focus distance requires an approximately 45° turn.

28-200mm is small and relatively light for its long zooming range, due in part to its moderate f/3.8 aperture. Wide, 2 in. textured rubber zoom/focus ring turns with some resistance from infinity to minimum normal focus range in a 90° turn, with virtually no slippage when lens is held vertically. 1/4 in.-wide indented metal aperture ring clicks noticeably in full-stop increments. Push the zoom/focus ring forward 1-1/2 in. to zoom all the way from 28-200mm. Turn additional 90° clockwise for macro, indicated clearly in orange on black. Clear white-on-black lettering indicates f/stops, meter distance, depth-of-field scale. Green letters indicate footage distances, A setting and maximum focal length.

**Field test slides:** Slides shot with 28-135mm were crisp and snappy overall. Corner softness was noticeable at 28mm and maximum aperture, but improved by f/8. Corner equaled center sharpness by f/11. Slight light falloff in corners at widest apertures was almost gone by f/5.6. Barrel distortion noted. At 50mm and 135mm, corner softness and light falloff improved one stop down. At 135mm, pincushion distortion noted. Flare controlled throughout. Overall, average performance for this type of zoom; macro performance just below average.

Test slides shot with the 28-200mm were crisp and contrasty. At 28mm, corner equaled center sharpness by f/8, light falloff was almost gone by f/4. Barrel distortion was noticeable. At 100 and 200mm, corner sharpness equaled center by f/11. At 200mm, pincushion distortion was noticeable. Light falloff was almost gone by f/8. Flare was well controlled, but in extreme conditions at 200mm contrast might be affected. Macro performance was average. Overall, an average performance for a wide to tele zoom.

**Optical bench analysis** (for optical experts only): At 28mm, on axis, 28-135mm showed very slight overcorrected spherical aberration. Red-yellow flare gone by f/8. Diffraction limit was reached by f/11. Off axis, at 28mm, very slight skew-ray flare mixed with very slight astigmatism. Lateral color.

On axis at 50mm, very slight yellow flare gone by f/11. Diffraction limit was reached by f/11. Off axis at 50mm, very slight skew-ray flare mixed with very slight coma. Lateral color present.



## 50mm ZEISS DISTAGON FOR HASSELBLAD

**Specifications:** 50mm f/4 Zeiss CF Distagon for Hasselblad 2 $\frac{1}{4}$ x2 $\frac{1}{4}$  in. (6x6 cm) medium format SLRs; No.6666698; accepts Hasselblad bayonet 60 filters; f/4-22, half-stop detents; Prontor CF between-lens leaf shutter, with speeds from 1/500 sec. to B, F setting locks shutter open for use with focal plane shutter of Hasselblad 2000FCs; EV scale settings from 2 to 21; min. foc. dist. 19 in. (.48m);  $\frac{3}{8}$  in. long, 3 $\frac{1}{4}$  in. diam. (93 x 83mm); 1 lb., 11 $\frac{1}{2}$  oz. (790g). \$1590.

**Practical comments:** Relatively heavy medium format retrofocus wide angle now in a new semi-gloss black focusing mount with Prontor CF shutter, used with all new Hasselblad lenses from 38 to 250mm (with sole exception of the 40mm Distagon). Control rings are easier to set than those of previous 50mm Distagons—aperture and shutter-speed rings are uncoupled for independent adjustment until you push in a spring-loaded coupling button. Preview lever can now be locked and unlocked without opening lens to maximum aperture. New textured rubber focusing grip gives added control and comfort.

**Field test slides:** Our 2 $\frac{1}{4}$  test slides were uniformly sharp and contrasty. Corner sharpness was a bit low, improved by f/5.6. Slight light fall-off noted when wide open, was almost gone by f/5.6. A well above average performer for a medium retrofocus wide angle.

**Optical bench analysis** (for optical experts only): On axis, slight over-corrected spherical aberration. Performance was diffraction limited by f/8. Off axis, slight skew-ray flare was noted, mixed with slight astigmatism, but was gone by f/11. Lateral color noted throughout.

### PERFORMANCE

| Our Standard                                                 | as Tested |
|--------------------------------------------------------------|-----------|
| <b>Focal length: <math>\pm 5\%</math></b><br>(47.50-52.50mm) | 50.94mm   |
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/3.80-4.20)       | f/4.02    |

|                                     |                    |
|-------------------------------------|--------------------|
| <b>Distortion:</b><br>( $\pm 3\%$ ) | under 1% (pincshn) |
|-------------------------------------|--------------------|

|                                                                                 |           |
|---------------------------------------------------------------------------------|-----------|
| <b>Light falloff: at f/8</b><br>+1 stop from theoretical limit<br>(0-2.6 stops) | 2.5 stops |
|---------------------------------------------------------------------------------|-----------|

### RESOLUTION

#### DISTAGON 50mm f/4 at 1:20

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4   | Excellent     | 45 Excellent 36 |
| 5.6 | Excellent     | 64 Excellent 40 |
| 8   | Excellent     | 64 Excellent 40 |
| 11  | Excellent     | 70 Excellent 45 |
| 16  | Excellent     | 64 Excellent 40 |
| 22  | Excellent     | 57 Excellent 40 |

### CONTRAST

#### at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4   | High       | 60 High 45 |
| 5.6 | High       | 65 High 50 |
| 8   | High       | 73 High 52 |
| 11  | High       | 65 High 47 |
| 16  | High       | 57 High 40 |
| 22  | High       | 50 High 33 |

#### at 135mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 5.4 | High       | 50 High 41 |
| 8   | High       | 60 High 50 |
| 11  | High       | 58 High 47 |
| 16  | High       | 47 High 37 |
| 22  | Medium     | 35 Low 24  |

### PERFORMANCE

| Our Standard                                                                      | as Tested         |
|-----------------------------------------------------------------------------------|-------------------|
| <b>Focal length: <math>\pm 5\%</math></b><br>(26.60-29.40mm)<br>(190.00-210.00mm) | 29.28mm<br>197.19 |

|                                                                                   |                  |
|-----------------------------------------------------------------------------------|------------------|
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/3.61-3.99)<br>at 200mm: (f/5.32-5.88) | f/3.91<br>f/5.74 |
|-----------------------------------------------------------------------------------|------------------|

|                                                                       |                                   |
|-----------------------------------------------------------------------|-----------------------------------|
| <b>Distortion:</b><br>28mm: ( $\pm 2.5\%$ )<br>200mm: ( $\pm 2.5\%$ ) | 0.66% (barrel)<br>1.87% (pincshn) |
|-----------------------------------------------------------------------|-----------------------------------|

|                                                                                                                 |                        |
|-----------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>28mm: (0-2.0 stops)<br>200mm: (0-1.0 stops) | 0.9 stops<br>0.5 stops |
|-----------------------------------------------------------------------------------------------------------------|------------------------|

### RESOLUTION

#### COSINA 28-200mm f/3.8-5.6 at 28mm/1:55

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 3.8 | Excellent     | 55 Excellent 49 |
| 5.6 | Excellent     | 62 Excellent 49 |
| 8   | Excellent     | 69 Excellent 55 |
| 11  | Excellent     | 62 Excellent 55 |
| 16  | Excellent     | 55 Excellent 49 |
| 22  | Excellent     | 55 Excellent 49 |

#### at 100mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4.5 | Excellent     | 56 Excellent 45 |
| 5.6 | Excellent     | 63 Excellent 50 |
| 8   | Excellent     | 63 Excellent 50 |
| 11  | Excellent     | 56 Excellent 50 |
| 16  | V. Good       | 50 Excellent 45 |
| 22  | Good          | 45 Excellent 40 |

#### at 200mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 5.6 | Excellent     | 56 Excellent 45 |
| 8   | Excellent     | 56 Excellent 50 |
| 11  | Excellent     | 63 Excellent 56 |
| 16  | Excellent     | 56 Excellent 50 |
| 22  | Excellent     | 50 Excellent 45 |

### CONTRAST

#### COSINA 28-200mm f/3.8-5.6 at 28 mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 3.8 | High       | 40 High 30   |
| 5.6 | High       | 51 High 40   |
| 8   | High       | 60 High 50   |
| 11  | High       | 55 High 44   |
| 16  | High       | 45 Medium 34 |
| 22  | Low        | 35 Low 23    |

#### at 100mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 4.5 | High       | 43 High 32   |
| 5.6 | High       | 52 High 41   |
| 8   | High       | 60 High 57   |
| 11  | High       | 54 High 45   |
| 16  | High       | 45 Medium 33 |
| 22  | Low        | 33 Low 24    |

#### at 200mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 5.6 | High       | 53 High 40   |
| 8   | High       | 60 High 50   |
| 11  | High       | 54 High 44   |
| 16  | High       | 42 Medium 31 |
| 22  | Low        | 32 V. Low 22 |

On axis at 135mm, very slight overcorrected spherical aberration. Very slight axial color was gone by f/11. Diffraction limit was reached by f/16. Off axis at 135mm, very slight skew-ray flare mixed with very slight lateral color was seen.

On axis at 28mm, 28-200 showed very slight undercorrected spherical aberration. Diffraction limited by f/11. Off axis at 28mm, very slight skew-ray flare mixed with very slight astigmatism. Lateral color.

On axis at 100mm, very slight overcorrected spherical aberration with very slight red flare. Diffraction limit was reached by f/11. Off axis at 100mm, very slight skew-ray flare mixed with very slight astigmatism. Lateral color was present.

On axis at 200mm, very slight over corrected spherical with slight red-yellow flare gone by f/11. Diffraction limit at f/16.

### PERFORMANCE

| Our Standard                                                                      | as Tested          |
|-----------------------------------------------------------------------------------|--------------------|
| <b>Focal length: <math>\pm 5\%</math></b><br>(26.60-29.40mm)<br>(128.25-141.75mm) | 29.132mm<br>132.53 |

|                                                                                   |                  |
|-----------------------------------------------------------------------------------|------------------|
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/3.80-4.20)<br>at 135mm: (f/5.13-5.67) | f/4.14<br>f/5.64 |
|-----------------------------------------------------------------------------------|------------------|

|                                                                       |                                    |
|-----------------------------------------------------------------------|------------------------------------|
| <b>Distortion:</b><br>28mm: ( $\pm 2.5\%$ )<br>135mm: ( $\pm 2.5\%$ ) | 0.57% (pincshn)<br>0.93% (pincshn) |
|-----------------------------------------------------------------------|------------------------------------|

|                                                                                                                 |                        |
|-----------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>28mm: (0-2.0 stops)<br>135mm: (0-1.1 stops) | 0.8 stops<br>0.6 stops |
|-----------------------------------------------------------------------------------------------------------------|------------------------|

### RESOLUTION

#### COSINA 28-135mm f/4-5.4 at 28mm/1:55

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4   | Excellent     | 55 Excellent 49 |
| 5.6 | Excellent     | 62 Excellent 49 |
| 8   | Excellent     | 69 Excellent 55 |
| 11  | Excellent     | 69 Excellent 55 |
| 16  | Excellent     | 62 Excellent 49 |
| 22  | Excellent     | 55 Excellent 44 |

#### at 50mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 5   | Excellent     | 50 Excellent 45 |
| 5.6 | Excellent     | 56 Excellent 50 |
| 8   | Excellent     | 63 Excellent 50 |
| 11  | Excellent     | 63 Excellent 56 |
| 16  | Excellent     | 56 Excellent 50 |
| 22  | V. Good       | 50 Excellent 45 |

#### at 135mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 5.4 | Excellent     | 50 Excellent 45 |
| 8   | Excellent     | 56 Excellent 50 |
| 11  | Excellent     | 63 Excellent 56 |
| 16  | Excellent     | 56 Excellent 50 |
| 22  | V. Good       | 50 Excellent 45 |

### CONTRAST

#### COSINA 28-135mm f/4-5.4 at 28mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 4   | High       | 45 High 40   |
| 5.6 | High       | 56 High 45   |
| 8   | High       | 60 High 50   |
| 11  | High       | 58 High 46   |
| 16  | High       | 48 Medium 37 |
| 22  | Low        | 35 Low 24    |

#### at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 5   | High       | 46 High 38   |
| 5.6 | High       | 55 High 45   |
| 8   | High       | 61 High 50   |
| 11  | High       | 59 High 48   |
| 16  | High       | 49 Medium 37 |
| 22  | Low        | 34 Low 26    |



## 250mm f/4 ZEISS FOR HASSELBLAD

**Specifications:** 250mm f/4 Zeiss Tele-Tessar, No. 6674330 in Hasselblad bayonet mount for 2000FC body only, accepts 70mm bayonet accessories and adaptors; f/4 to f/32 with full and half-stop detents; cross-couples to camera focal plane shutter speed controls at press of button for EV setting, cross-coupling of shutter speeds and diaphragm adjustment. Lens mounted stop down lever and release. Min. foc. dist.; 8 ft. (2.4m); 6 1/8 in. long, 3 1/8 in. diam, (158x80mm), 2 lb. 2 oz. (972g). \$2.198.

**Practical comments:** New five-element formula for focal plane-shuttered 2000FC, FCM and FCW Hasselblad cameras permits wider aperture, closer focusing, lighter weight than 250mm f/5.6 for Hasselblad 500s. New mechanical design with 2 1/4 in. wide textured focusing grip, more convenient depth-of-field preview and normally uncoupled aperture and speed setting rings permits faster, more convenient operation. Black anodized barrel with footage and EV scales legibly engraved in orange, apertures and metric distance in white. Complete depth-of-field scale engraved in white. While lens is bulky, it is light in weight and balances well on the camera.

**Field test transparencies:** Our 2-1/4x2-1/4 in. transparencies were crisp and contrasty. Wide open edges and center were very slightly less sharp than one stop down. By f/5.6, overall sharpness was achieved. Flare was well controlled throughout. An above average lens for this focal length and format. **Optical bench analysis** (for optical experts only): On axis, we saw very slight undercorrected spherical aberration, very slight red flare. Diffraction limit reached by f/8. Off axis, very slight coma mixed with slight astigmatism, very slight lateral color throughout.

### PERFORMANCE

| Our Standard                                                                    | as Tested          |
|---------------------------------------------------------------------------------|--------------------|
| <b>Focal length: ±5%</b><br>(237.50-262.50mm)                                   | 244.92mm           |
| <b>Aperture: ±5%</b><br>(f/3.80-4.20)                                           | f/3.99             |
| <b>Distortion:</b><br>(±3.5%)                                                   | under 1% (pincshn) |
| <b>Light falloff: at f/8</b><br>+1 stop from theoretical limit<br>(0-1.3 stops) | 1.2 stops          |

### RESOLUTION

#### TELE-TESSAR 250mm f/4 at 1:20

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4   | Excellent     | 51 Excellent  |
| 5.6 | Excellent     | 58 Excellent  |
| 8   | Excellent     | 58 Excellent  |
| 11  | Excellent     | 64 Excellent  |
| 16  | Excellent     | 58 Excellent  |
| 22  | Excellent     | 51 Excellent  |
| 32  | Excellent     | 46 Excellent  |

### CONTRAST

#### TELE-TESSAR 250mm f/4 at 30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4   | High       | 57 High    |
| 5.6 | High       | 68 High    |
| 8   | High       | 72 High    |
| 11  | High       | 69 High    |
| 16  | High       | 54 High    |
| 22  | High       | 44 High    |
| 32  | High       | 34 High    |

## 100-200 f/4.5 AF FOR MAXXUM

**Specifications:** 100–200mm f/4.5 Minolta Maxxum AF (autofocus) No. 1015078, in Minolta A bayonet mount, accepts 49mm accessories f/4.5–22 set electronically by camera, min. foc. dist.: 6 ft. 4 in. (1.9M); clip-on lens shade reverses for storage; 3-3/4 in. long, 2-3/4 in. diam. (95–70mm); 13-5/16 oz. (377g.) \$205.

**Practical comments:** Excellent satin black finish with 3/4 in. textured rubberized grip on 1-1/4 in. wide zoom ring. Distance scales visible in window; clear, legible with feet (yellow) and meters (white) plus IR focus index. Narrow, ribbed ring controls focus from infinity to close focus achieved in 1.1 secs. at 100mm and 1:3 secs. at 200mm, on Maxxum 7000.

**Field test slides:** Our slides were crisp and snappy with flare very well controlled throughout entire focal length and aperture range. Fine detail was well rendered and held well across frame at all apertures. Image quality was consistent for all focal lengths. Performance was judged to be above average for a lens of this type.

**Optical bench analysis** (for optical experts only): On axis at 100mm, we found very slight overcorrected spherical aberration mixed with very slight axial color. Both disappeared by f/8. Diffraction limit was reached by f/16. Off axis we saw very slight coma mixed with very slight astigmatism to f/11. Slight lateral color was observed.

At 150mm and 200mm, on and off axis, the optical bench observations were identical to those at 100mm.

### PERFORMANCE

| Our Standard                                                                                                     | as Tested                          |
|------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length: ±5%</b><br>( 95.00-105.00mm)<br>(190.00-210.00mm)                                               | 102.18mm<br>197.65mm               |
| <b>Aperture: ±5%</b><br>(f/4.28-4.73)<br>at 200mm: (f/4.28-4.73)                                                 | f/4.71<br>f/4.72                   |
| <b>Distortion:</b><br>100mm: (±2%)<br>200mm: (±2.5%)                                                             | 0.97% (pincshn)<br>2.38% (pincshn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>180mm: (0-1.1 stops)<br>200mm: (0-1.0 stops) | 0.5 stops<br>0.9 stops             |

### RESOLUTION

#### MAXXUM 100-200mm f/4.5 at 100mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4.5 | Excellent     | 56 Excellent  |
| 5.6 | Excellent     | 63 Excellent  |
| 8   | Excellent     | 63 Excellent  |
| 11  | Excellent     | 63 Excellent  |
| 16  | Excellent     | 56 Excellent  |
| 22  | V. Good       | 50 Excellent  |

#### at 150mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4.5 | Excellent     | 56 Excellent  |
| 5.6 | Excellent     | 56 Excellent  |
| 8   | Excellent     | 63 Excellent  |
| 11  | Excellent     | 63 Excellent  |
| 16  | Excellent     | 56 Excellent  |
| 22  | Excellent     | 50 Excellent  |

#### at 200mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 4.5 | Excellent     | 50 Excellent  |
| 5.6 | Excellent     | 50 Excellent  |
| 8   | Excellent     | 56 Excellent  |
| 11  | Excellent     | 56 Excellent  |
| 16  | Excellent     | 50 Excellent  |
| 22  | Excellent     | 45 Excellent  |

### CONTRAST

#### MAXXUM 100-200 f/4.5 at 100mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4.5 | High       | 51 High    |
| 5.6 | High       | 58 High    |
| 8   | High       | 61 High    |
| 11  | High       | 50 High    |
| 16  | High       | 44 High    |
| 22  | Medium     | 38 Medium  |

#### at 150mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4.5 | High       | 57 High    |
| 5.6 | High       | 59 High    |
| 8   | High       | 64 High    |
| 11  | High       | 50 High    |
| 16  | High       | 41 High    |
| 22  | Medium     | 38 Medium  |

#### at 200mm/30 lines/mm

| f/  | Center (%) | Corner (%) |
|-----|------------|------------|
| 4.5 | High       | 56 High    |
| 5.6 | High       | 59 High    |
| 8   | High       | 62 High    |
| 11  | High       | 50 High    |
| 16  | High       | 42 High    |
| 22  | Medium     | 37 Medium  |

## 35-105mm f/3.5-4.5 AF ZOOM-NIKKOR

**Specifications:** 35–105mm f/3.5–4.5 AF Zoom-Nikkor, No.2004056 in Nikon autofocus A1-S bayonet mount, accepts 52mm accessories and bayonet lens hood; f/3.5 (f/4.5 at 105mm) to f/22 (f/28 at 105mm) with full stop detents beginning at f/4, aperture indicators for both 35 and 135mm focal lengths; minimum aperture lock, min. foc. dist.: 5 ft. (1.4m); continuous manual macro focusing with zoom ring beyond 105mm to 1:3.5 magnification; 3-3/4 in. long, 2-3/5 in. diam. (87 x 69mm); 16-1/2 oz. (460g). \$475.

**Practical comments:** Smooth auto and manual focusing with manual focusing ring. Highly legible scales in white on satin block, no depth of field scale on lens. With Nikon 2020AF camera, use autofocus indicator as an aid in macro focusing mode since autofocus isn't possible in macro, focal length markings at 35, 50, 70, 105mm and macro positions.

**Field test slides:** Images were crisp and snappy with detail well rendered. At 35, 50 and 105mm, slight softness was noted in the corners with very slight color fringing almost gone by one stop down. At 35mm, the corners equaled center sharpness by f/8. Very slight barrel distortion was noted. At 50mm, corner sharpness equaled center sharpness by f/5.6.

Very slight pincushion distortion was noted. At 70mm, corner sharpness equaled center sharpness by f/5.6. Again, very slight pincushion distortion was noted. Flare was well controlled throughout. In macro, the slide quality was acceptable and by f/11, the quality was slightly above average for this type of zoom. Overall, we estimated the lens to be average to slightly above average for this type of short focal length zoom.



**Optical bench analysis** (for optical experts only): At 35mm, on axis, very slight overcorrected spherical aberration was noted with very slight red flare gone two stops down. Diffraction limit was reached by f/16. Off axis, very slight skew-ray flare was visible mixed with very slight coma. Lateral color throughout.

At 50mm, on axis, very slight undercorrected spherical aberration was visible with very slight red flare gone two stops down. The diffraction limit was reached by f/16. Off axis, very slight skew-ray flare was mixed with very slight astigmatism, which was gone by f/16. Lateral color was seen throughout.

At 105mm, on axis, very slight overcorrected spherical aberration was present with very slight red flare gone by two stops down. The diffraction limit was reached by f/16. Very slight skew-ray flare mixed with very slight coma was visible. This was almost gone by f/16. Lateral color was present throughout.

## PERFORMANCE

| Our Standard                                                                                                    | as Tested                          |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Focal length: <math>\pm 5\%</math></b><br>(33.25-36.75mm)<br>(99.75-110.25mm)                                | 35.23mm<br>105.53mm                |
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/1.33-3.68)<br>at 105mm: (f/4.28-4.73)                               | f/3.63<br>f/4.71                   |
| <b>Distortion:</b><br>35mm: ( $\pm 2.5\%$ )<br>105mm: ( $\pm 2.5\%$ )                                           | 0.48% (barrel)<br>0.47% (pincushn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>35mm: (0-1.9 stops)<br>105mm: (0-1.1 stops) | 0.5 stops<br>0.4 stops             |

## RESOLUTION

### NIKOR AF 35-105mm f/3.5-4.5 at 35mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 3.5 | Excellent     | 56 Excellent 45 |
| 5.6 | Excellent     | 63 Excellent 50 |
| 8   | Excellent     | 70 Excellent 56 |
| 11  | Excellent     | 63 Excellent 56 |
| 16  | Excellent     | 63 Excellent 50 |
| 22  | Excellent     | 56 Excellent 50 |

### at 50mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 3.8 | Excellent     | 56 Excellent 50 |
| 5.6 | Excellent     | 63 Excellent 56 |
| 8   | Excellent     | 70 Excellent 63 |
| 11  | Excellent     | 63 Excellent 56 |
| 16  | Excellent     | 63 Excellent 50 |
| 22  | Excellent     | 56 Excellent 45 |

### at 105mm/1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4.5 | Excellent     | 56 Excellent 50 |
| 5.6 | Excellent     | 63 Excellent 56 |
| 8   | Excellent     | 70 Excellent 63 |
| 11  | Excellent     | 63 Excellent 56 |
| 16  | Excellent     | 56 Excellent 50 |
| 22  | Excellent     | 56 Excellent 50 |

## MACRO RESOLUTION

### at 105mm/1:4

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 4.5 | Good          | 40 Excellent 32 |
| 5.6 | Good          | 45 Excellent 40 |
| 8   | Good          | 51 Excellent 45 |
| 11  | Good          | 45 Excellent 40 |
| 16  | Accept.       | 40 V. Good 36   |
| 22  | Accept.       | 40 V. Good 36   |

## CONTRAST

### at 35mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 3.5 | Medium     | 30 Medium 25 |
| 5.6 | Medium     | 40 Medium 30 |
| 8   | Medium     | 49 Medium 37 |
| 11  | High       | 45 Medium 35 |
| 16  | Medium     | 40 Medium 30 |
| 22  | Low        | 31 Low 24    |

### at 50mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 3.8 | Medium     | 30 Low 20    |
| 5.6 | High       | 50 High 38   |
| 8   | High       | 53 Medium 41 |
| 11  | High       | 50 Medium 39 |
| 16  | Medium     | 41 Low 30    |
| 22  | V. Low     | 29 V. Low 20 |

### at 105mm/30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 4.5 | Medium     | 35 Medium 25 |
| 5.6 | High       | 50 High 36   |
| 8   | High       | 57 High 45   |
| 11  | High       | 50 High 38   |
| 16  | High       | 41 Medium 30 |
| 22  | Low        | 30 V. Low 20 |

## ULTRA-FAST 90mm f/2 OLYMPUS MACRO

**Specifications:** 90mm f/2 Olympus Zuiko Auto-Macro, No.101413 macro lens, accepts 55mm accessories; f/2 to 22, with full-stop detents; min. foc. dist.: 1.3 ft. (.4m) (1:2 scale), smallest area covered: 48mm x 72mm, 1-13/16x2-3/4 in., 2-3/4 in. long, 2-3/4 in. diam. (72mm x 70mm); 19.5 oz. (549g). \$620 w/ case.

**Practical comments:** Smooth manual focusing to half life-size (1:2) with 1-1/8 in.-wide diamond-patterned rubber focusing ring. Distance scale clearly engraved in orange to 1.3 ft., magnification scale in yellow to 1:2. White depth-of-field scales for f/11 and 22 only because of lack of space. Red index for infrared refocusing. Rear-mounted, well-spaced aperture scale in white, detented at full and half stops. 340° clockwise turn of focusing ring extends lens to its full 4-5/8 in. for maximum close focus. Compact but massive lens is not weighty for its high speed and double-acting helical mount, balances well on lightweight OM bodies for hand-held and tripod-mounted work. Image snaps into focus decisively and is still easily focusable at longer distances, unlike some longer macros that are touchy to focus beyond 15 ft.

**Field test slides:** Slides shot at normal distances were crisp and high in contrast. Very slight color fringing seen in corners, disappeared by f/2.8. Corners equaled central sharpness by f/4. Flare was well controlled throughout. In macro, results were average at wide apertures, improving as you stopped down. Resolution held up to f/22, slight contrast falloff attributed to diffraction appeared after f/16. An above average performance for any long macro, especially so for a 90mm f/2.

**Optical bench report** (for optical experts only): On axis, we saw very slight overcorrected spherical aberration with very slight yellow-red flare (which disappeared by f/5.6). Diffraction limit was reached by f/16. Off axis, we saw very slight coma mixed with very slight astigmatism, almost gone by f/16. Lateral color present.

## Interchangeable Lenses

## PERFORMANCE

| Our Standard                                                                            | as Tested |
|-----------------------------------------------------------------------------------------|-----------|
| <b>Focal length: <math>\pm 5\%</math></b><br>(85.50-94.50mm)                            | 90.44mm   |
| <b>Aperture: <math>\pm 5\%</math></b><br>(f/1.90-2.10)                                  | f/2.04    |
| <b>Distortion:</b><br>90mm: (0-1.2 stops)                                               | 0.3 stops |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>90mm: (0-1.2 stops) | 0.3 stops |

## RESOLUTION

### ZUIKO 90mm f/2 at 1:50

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 2   | Excellent     | 56 Excellent 50 |
| 2.8 | Excellent     | 56 Excellent 50 |
| 4   | Excellent     | 63 Excellent 50 |
| 5.6 | Excellent     | 70 Excellent 56 |
| 8   | Excellent     | 70 Excellent 63 |
| 11  | Excellent     | 63 Excellent 56 |
| 16  | Excellent     | 56 Excellent 50 |
| 22  | V. Good       | 50 Excellent 45 |

## MACRO RESOLUTION

### at 1:4

| f/  | Center (l/mm) | Corner (l/mm) |
|-----|---------------|---------------|
| 2   | Accept.       | 40 V. Good 32 |
| 2.8 | Good          | 45 V. Good 36 |
| 4   | Good          | 45 Accept. 36 |
| 5.6 | V. Good       | 51 Good 40    |
| 8   | Good          | 45 Good 40    |
| 11  | Accept.       | 40 Accept. 36 |
| 16  | Accept.       | 40 Accept. 36 |
| 22  | Accept.       | 40 Accept. 36 |

### at 1:2

| f/  | Center (l/mm) | Corner (l/mm)   |
|-----|---------------|-----------------|
| 2   | Accept.       | 40 Excellent 36 |
| 2.8 | Good          | 45 V. Good 36   |
| 4   | Good          | 45 V. Good 36   |
| 5.6 | Good          | 45 Good 40      |
| 8   | V. Good       | 51 Good 40      |
| 11  | Good          | 45 Good 40      |
| 16  | Accept.       | 40 Accept. 36   |
| 22  | Accept.       | 40 Accept. 36   |

## CONTRAST

### ZUIKO 90mm f/2 at 30 lines/mm

| f/  | Center (%) | Corner (%)   |
|-----|------------|--------------|
| 2   | Low        | 30 Low 25    |
| 2.8 | Medium     | 47 Medium 30 |
| 4   | High       | 69 Medium 43 |
| 5.6 | High       | 68 High 45   |
| 8   | High       | 60 High 50   |
| 11  | High       | 54 High 42   |
| 16  | High       | 48 High 40   |
| 22  | Low        | 33 Low 27    |

## WIDE f/2.8 AND 28-200mm SOLIGORS

**Specifications:** 28-200mm f/3.8-5.5 Soligor C/D Zoom + Macro, No.885209764. Mounts for Canon, Fujica AX, Konica, Nikon AIS, Minolta MD, Olympus, Pentax thread and KA, Ricoh XR-P and Yashica/Contax, accepts 72mm accessories, f/3.8-f/22 with full stop detents; min. foc. dist.: 8.3 ft. (2.5m); macro to 1:4 magnification at 200mm only; 4<sup>5</sup>/<sub>8</sub> in. long, 2<sup>15</sup>/<sub>16</sub> in. diam. (117 x 75mm); 24 oz. (680g). \$319.95.



## Interchangeable Lenses

**Specifications:** 20mm f/2.8 Soligor C/D Wide-Auto, No.88621633, mounts for Canon, Konica, Minolta MD, Nikon AIS, Olympus, Pentax thread and K (KA soon), Ricoh XR-P (soon) and Yashica/Contax, accepts 58mm accessories, f/2.8-22 with full stop detents; min. foc. dist.: 7 $\frac{1}{8}$  in. (0.2m); 1 $\frac{1}{2}$  in. long, 2 $\frac{7}{16}$  in. diam. (38 x 62mm); 7 $\frac{3}{4}$  oz. (210g). \$199.95.

**Practical Comments:** Zoom is smooth operating single touch with 2 $\frac{1}{8}$  in. wide, rubberized, grip surface control ring, continuous focusing to 1:4 macro with 160° clockwise turn of control ring from infinity; bright black barrel finish, clear, large numerals with meters in white, feet in green. Reasonably light and compact for zoom of these specifications.

20mm f/2.8 focusing ring fairly smooth with 90° clockwise turn of 7 $\frac{1}{16}$  in. wide rubberized grip surface to close focus from infinity; satin black barrel finish, well marked with meters in white, feet in green. Remarkably compact and light in weight.

**Field test slides:** Zoom lens images were crisp and snappy. At 28mm very slight color fringing could be seen in the corners of the slides at full aperture. This disappeared by f/8. Corner sharpness equalled the center by f/8. Slight barrel distortion was noticeable. At 100mm, corner again equalled center by f/8. At 200mm slight softness was seen wide open but improved by f/8. Pincushion distortion was noticeable. Flare was well controlled throughout. Macro results were superior for a lens of this type although not equal to what could be expected from a macro focusing lens designed for that purpose. Overall performance above average for a zoom of this type.

Slides from the 20mm f/2.8 Soligor also provided crisp and snappy subjects with slight softness at full aperture. However by f/5.6 sharpness improved considerably and corner sharpness equalled center. Color fringing in the corners was gone by f/5.6. Pincushion distortion was noticeable. Flare was well controlled throughout. Overall, an above average performance for this lens.

**Optical bench analysis** (for optical experts only): On axis at 28mm, the zoom lens showed very slight undercorrected spherical aberration with very slight yellow flare. The latter was gone by f/8. The diffraction limit was reached by f/11. Off axis, very slight coma mixed with very slight astigmatism. Both were virtually gone by f/11. Lateral color was minimal.

At 100mm, on axis, very slight overcorrected spherical aberration was visible with very slight flare, the latter gone by f/8. The diffraction limit was reached by f/16. Off axis, there was very slight skew-ray flare mixed with very slight astigmatism. Lateral color was very minimal.

At 200mm, on axis, there was very slight undercorrected spherical aberration. Very slight flare was gone by f/8. The diffraction limit was reached by f/16. Off axis, very slight coma could be seen mixed with very slight astigmatism, gone by f/11. Lateral color was minimal.

The 20mm f/2.8 Soligor on axis showed very slight undercorrected spherical aberration with very slight axial color, gone by f/5.6. The diffraction limit was reached by f/8. Off axis, very slight skew-ray flare could be seen mixed with very slight astigmatism gone by f/11. Lateral color was minimal.

### PERFORMANCE

| Our Standard                                                                      | as Tested       |
|-----------------------------------------------------------------------------------|-----------------|
| <b>Focal length: ±5%</b><br>(19.00-21.00mm)                                       | 20.44mm         |
| <b>Aperture: ±5%</b><br>(f/2.66-2.94)                                             | f/2.84          |
| <b>Distortion:</b><br>(±4%)                                                       | 1.35% (pincshn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>(0-3.0 stops) | 1.0 stops       |

### RESOLUTION

| SOLIGOR 20mm f/2.8<br>at 1:49 |               |               |    |
|-------------------------------|---------------|---------------|----|
| f/                            | Center (l/mm) | Corner (l/mm) |    |
| 2.8                           | V. Good       | 49 Excellent  | 39 |
| 4                             | V. Good       | 55 Excellent  | 44 |
| 5.6                           | Excellent     | 62 Excellent  | 49 |
| 8                             | Excellent     | 62 Excellent  | 55 |
| 11                            | V. Good       | 55 Excellent  | 49 |
| 16                            | V. Good       | 55 Excellent  | 49 |
| 22                            | Good          | 49 Excellent  | 44 |

### CONTRAST

| at 20mm/30 lines/mm |            |            |    |
|---------------------|------------|------------|----|
| f/                  | Center (%) | Corner (%) |    |
| 2.8                 | High       | 45 High    | 30 |
| 4                   | High       | 53 High    | 36 |
| 5.6                 | High       | 56 Medium  | 37 |
| 8                   | High       | 58 Medium  | 37 |
| 11                  | High       | 56 Medium  | 35 |
| 16                  | High       | 50 Medium  | 34 |
| 22                  | High       | 46 Medium  | 33 |

### PERFORMANCE

| Our Standard                                                                                                           | as Tested                         |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Focal length: ±5%</b><br>(26.60-29.40mm)<br>(190.00-210.00mm)                                                       | 28.98mm<br>192.16mm               |
| <b>Aperture: ±5%</b><br>(f/3.61-3.99)<br>at 200mm: (f/5.23-5.78)                                                       | f/3.88<br>f/5.78                  |
| <b>Distortion:</b><br>28mm: (±2.5%)<br>200mm: (±2.5%)                                                                  | 1.87% (barrel)<br>2.33% (pincshn) |
| <b>Light falloff: at f/5.6</b><br>+1 stop from theoretical limit<br>28mm: (0-2.0 stops)<br>200mm: at f/8 (0-1.0 stops) | 0.7 stops<br>0.5 stops            |

### RESOLUTION

| SOLIGOR 28-200mm f/3.8-5.5<br>at 28mm/1:50 |               |               |    |
|--------------------------------------------|---------------|---------------|----|
| f/                                         | Center (l/mm) | Corner (l/mm) |    |
| 3.8                                        | V. Good       | 45 Excellent  | 40 |
| 5.6                                        | Excellent     | 50 Excellent  | 45 |
| 8                                          | Excellent     | 56 Excellent  | 50 |
| 11                                         | Excellent     | 63 Excellent  | 56 |
| 16                                         | Excellent     | 56 Excellent  | 50 |
| 22                                         | Excellent     | 50 Excellent  | 45 |

### at 100mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |    |
|-----|---------------|---------------|----|
| 4.5 | Excellent     | 50 Excellent  | 45 |
| 5.6 | Excellent     | 56 Excellent  | 50 |
| 8   | Excellent     | 63 Excellent  | 56 |
| 11  | V. Good       | 56 Excellent  | 50 |
| 16  | V. Good       | 50 Excellent  | 45 |
| 22  | V. Good       | 50 Excellent  | 45 |

### at 200mm/1:50

| f/  | Center (l/mm) | Corner (l/mm) |    |
|-----|---------------|---------------|----|
| 5.5 | Excellent     | 50 Excellent  | 45 |
| 8   | Excellent     | 56 Excellent  | 50 |
| 11  | Excellent     | 63 Excellent  | 50 |
| 16  | Excellent     | 56 Excellent  | 45 |
| 22  | Excellent     | 50 Excellent  | 45 |

### MACRO RESOLUTION

| at 200mm/1:4 |               |               |    |
|--------------|---------------|---------------|----|
| f/           | Center (l/mm) | Corner (l/mm) |    |
| 5.5          | Good          | 32 V. Good    | 28 |
| 8            | V. Good       | 36 Excellent  | 32 |
| 11           | V. Good       | 40 Good       | 32 |
| 16           | Good          | 36 Good       | 32 |
| 22           | Accept        | 32 Accept     | 28 |

### CONTRAST

| at 28mm/30 lines/mm |            |            |    |
|---------------------|------------|------------|----|
| f/                  | Center (%) | Corner (%) |    |
| 3.8                 | High       | 47 High    | 38 |
| 5.6                 | High       | 50 High    | 41 |
| 8                   | High       | 53 High    | 45 |
| 11                  | High       | 56 High    | 46 |
| 16                  | High       | 49 Medium  | 37 |
| 22                  | Low        | 31 Low     | 27 |

### at 100mm/30 lines/mm

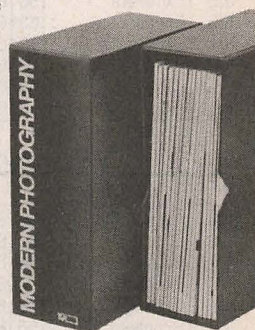
| f/  | Center (%) | Corner (%) |    |
|-----|------------|------------|----|
| 4.5 | High       | 48 High    | 37 |
| 5.6 | High       | 53 High    | 40 |
| 8   | High       | 54 High    | 44 |
| 11  | High       | 55 High    | 45 |
| 16  | High       | 46 High    | 37 |
| 22  | Low        | 31 Low     | 27 |

### at 200mm/30 lines/mm

| f/  | Center (%) | Corner (%) |    |
|-----|------------|------------|----|
| 5.5 | High       | 50 High    | 38 |
| 8   | High       | 55 High    | 44 |
| 11  | High       | 56 High    | 45 |
| 16  | High       | 45 High    | 42 |
| 22  | Low        | 30 Low     | 27 |

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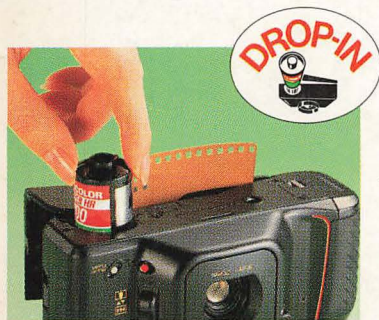
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